OWNERSHIP NETWORK STRUCTURE AND DECISION-CONTROL BEHAVIOUR OF EIGHT MAJOR OIL PALM COMPANIES IN MALAYSIA

By

NORFARYANTI KAMARUDDIN

Management and Supervision- Jean-Marc Roda (INTROP-Universiti Putra Malaysia, Serdang, Malaysia / CIRAD-UR Forêts & Sociétés)

Composition of Jury

President - Ahmad Ainuddin Nuruddin (Universiti Putra Malaysia, Serdang, Malaysia)

Rapporteurs:

Hishamuddin Zainuddin (Universiti Putra Malaysia, Serdang, Malaysia), Bany Ariffin Md Amin Noordin (Univeristi Putra Malaysia, Serdang, Malaysia), Philippe Cadene (Université Paris Diderot, Paris, France)

Examiners:

Edmund Terence Gomez (University Malaya, Kuala Lumpur, Malaysia), Shaufique Fahmi Ahmad Siddique (Universiti Putra Malaysia, Serdang, Malaysia), Paridah Md Tahir (Universiti Putra Malaysia, Serdang, Malaysia)

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Doctor Philosophy

Defense date: 8th October 2018

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

OWNERSHIP NETWORK STRUCTURE AND DECISION-CONTROL BEHAVIOUR OF EIGHT MAJOR OIL PALM COMPANIES IN MALAYSIA

By

NORFARYANTI KAMARUDDIN

October 2018

Chair : Jean-Marc Roda, PhD
Faculty: Institute of Tropical Forestry and Forest Products

Decisions made by the government-linked companies (GLCs) and family-owned businesses (FOBs) are seen to be fundamentally different. This issue has become more pertinent now that ownership and control structures of major oil palm corporations have become far more complex in the context of growing and intense competition. This study analysed whether the control and decision-making is determined by the type of owner, i.e. the government or a family.

In the palm oil, forestry and biomass sectors, where GLCs and family-owned companies are present as big businesses, there is a major gap in understanding what drives their decision-making. Agribusiness corporations deal with challenging decisions that have economic, social and environmental implications, regardless of their ownership. The global agriculture sector is under the process of more financialisation, precisely through the extension of major agribusiness corporations. Understanding what really drives their decision making, be it their control patterns or other factors is of extreme importance for the sustainability of agricultural sectors worldwide.

The study was designed to analyse how the ownership structure inform decision-making behaviour by the of oil palm corporations owned by the government and family. This is a pioneering study that seeks to quantify and to assess the ownership and control patterns of two very different types of plantation companies. GLCs (Sime Darby, Boustead, IJM Plantations, and Kulim) and FoBs (IOI Corp, KLK, Genting Plantations, and Jaya Tiasa) are compared for their similarities and differences, and finally, analysed their decision-making behaviour.

A network analysis was employed in quantifying and analysing the corporate structures of eight major Malaysian oil palm corporations. The data were obtained from various reputable sources. There are 4,331 companies' shareholding data gathered, covering ten levels of shareholding.

The shareholdings data generated network topology graphs with its network centrality metrics. It explained the characteristic (pyramid levels, average ownership tier, subsidiaries degree, shareholding degree, hierarchy index structural control (betweenness) and decisions load (stress)) of the eight corporate networks structure. Based on the metrics, the research decipher their decision-making control behaviour.

T-test was done to respond to whether GLCs and FOBs are similar or different. Linear regression was run to obtain further insights on the companies' decision-making behaviour pattern. The model was validated to further understand the decision-making behaviour.

Based on the network centrality metrics comparison, the eight companies displayed variations in their designs of ownership structure. Not all GLCs structural control is significantly different from FOBs. The structural control did not appear to have any association with the ownership identity. There is a high similarity pattern of decisions load amongst the eight companies. Within FOBs, the decisions load for all four companies are similar.

Linear regression models showed a linear pattern of increasing decisions load as the structural control increases. Global model presented a better fitted model to understand their decision-making behaviour.

The global model explained that the eight companies were scattered and not inclined to their ownership identity. Three groups had appeared: Boustead was in Group 1; Sime Darby, KLK, IOI Corp, IJM Plantations and Genting Plantations were in Group 2; and Jaya Tiasa and Kulim were in Group 3. The groupings signify their similarity in decision-making behaviour pattern. However, each companies were different in terms of the decisions load given the same subsidiaries' structural control and vice versa. Even though the companies belonged to the same group, followed the same linear pattern of increasing decisions load when structural control increased, their decisions load are all different given the same structural control. There was an emerging behaviour derived from the intercepts of the decisions load and structural control relationship. This research regards the behaviour as structural flexibility. The structural flexibility of the companies was highly dependent on the number of subsidiaries, hierarchy index and pyramid size.

Based on the results, the analysis showed that each company, whether a GLC or a family-owned enterprise, functioned differently. Their decision-making behaviour depended less on ownership type and more on the topology or design of the structure, such as the number of the companies, hierarchy index, and the pyramid size. The different levels of decisions load and control denote a variety of flexibility patterns.

The analyses proved that the ownership structure of a company influenced their decision-making behaviour. This research concluded that their decision-making control behaviour depended less on ownership type and more on the topology or design of the ownership structure. Both of the GLCs and FOBs have similarities and differences in their decision-making behaviour. The results may contradict with some other studies and it opens a new field of research and analysis of corporations, regardless of their ownership type/identity (government-owned or family-owned). This method allows us to evaluate the ownership topology structure quantitatively and qualitatively. Furthermore, these companies can be ranked based on the analysis used in this research.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia
Sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

STRUKTUR RANGKAIAN PEMILIKAN DAN TINGKAH LAKU KAWALAN KEPUTUSAN DI LAPAN SYARIKAT UTAMA MINYAK KELAPA SAWIT DI MALAYSIA

Oleh

NORFARYANTI KAMARUDDIN

Oktober 2018

Pengerusi : Jean-Marc Roda, PhD
Fakulti : Institut Perhutanan Tropika dan Produk Hutan

Keputusan yang dibuat oleh syarikat berkaitan Kerajaan (GLC) dan perniagaan milik keluarga (FOB) dilihat berbeza. Isu ini menjadi lebih penting apabila struktur pemilikan dan kawalan syarikat minyak kelapa sawit utama menjadi jauh lebih kompleks dalam konteks persaingan yang semakin meningkat dan sengit. Kajian ini menganalisis sama ada kawalan dalam membuat keputusan ditentukan oleh jenis pemilik, iaitu kerajaan atau keluarga, atau struktur pemilikan syarikat.

Di sektor minyak kelapa sawit, perhutanan dan biomas, di mana syarikat-syarikat GLC dan syarikat milik keluarga hadir sebagai perniagaan besar. Terdapat jurang utama dalam memahami apa yang mendorong proses membuat keputusan mereka. Perusahaan perniagaantani menghadapi cabaran yang mencabar apabila pembuatan keputusan mereka merangkumi implikasi ekonomi, sosial, dan alam sekitar, tanpa mengira pemilikan mereka. Sektor pertanian global berada di bawah proses '*financialisation'*, melalui syarikat-syarikat perniagaantani utama. Memahami apa yang benar-benar mendorong keputusan mereka, sama ada corak kawalan mereka atau faktor-faktor lain, adalah sangat penting bagi kemapanan sektor pertanian di seluruh dunia.

Kajian ini dirancang untuk menganalisis bagaimana struktur pemilikan memaklumkan tingkah laku pengambilan keputusan oleh syarikat-syarikat kelapa sawit yang dimiliki oleh kerajaan dan keluarga. Ini adalah kajian perintis yang bertujuan untuk mengkuantifikasi dan menilai pola pemilikan dan kawalan dua jenis syarikat perladangan yang sangat berbeza. Kajian ini terdiri daripada dua kumpulan pemilikan syarikat, GLC (Sime Darby, Boustead, IJM Plantations, dan Kulim) dan FoB (IOI Corp, KLK, Genting Plantations, dan Jaya Tiasa). Syarikat di dalam setiap kumpulan dibandingkan, untuk menilai persamaan dan

perbezaan mereka, dan menganalisis kelakuan mereka yang membuat keputusan.
Analisis rangkaian digunakan dalam mengkuantifikasi dan menganalisis struktur korporat lapan syarikat utama kelapa sawit Malaysia. Data diperoleh dari pelbagai sumber yang bereputasi. Terdapat 4,331 data pegangan saham syarikat yang dikumpulkan, meliputi sepuluh peringkat pegangan saham.

Data pemegangan saham menghasilkan graf topologi rangkaian dengan metrik sentraliti. Metrik rangkaian menjelaskan sifat (tahap piramid, peringkat pemilikan purata, darjah anak syarikat, darjah kepemilikan saham, indeks hierarki, kawalan struktur (*Betweenness*) dan beban keputusan (*Stress*)) dari lapan rangkaian struktur korporat. Berdasarkan metrik rangkaian ini, tingkah laku membuat keputusan dinilai.

Ujian-T(*T-test*) telah dilakukan untuk memberi respons kepada sama ada GLC dan FOB adalah sama atau berbeza. Regresi linear dijalankan dengan menggunakan model regresi untuk mendapatkan gambaran lanjut tentang corak tingkah laku pengambilan keputusan syarikat. Model ini telah disahkan untuk terus memahami tingkah laku keputusan.

Berdasarkan perbandingan metrik pusat yang sederhana, lapan syarikat mempamerkan pelbagai reka bentuk struktur pemilikan. Perbandingan metrik rangkaian lanjutan telah dilakukan menggunakan ujian T. Keputusan menunjukkan bahawa kawalan struktur untuk semua syarikat mempunyai persamaan dan perbezaan. Tidak semua kawalan struktur GLC berbeza dengan FOB. Kawalan struktur tidak kelihatan bersekutu dengan identiti pemilikan. Terdapat corak persamaan tinggi keputusan yang diambil di kalangan lapan syarikat. Di dalam FOB, keputusan yang diambil untuk semua empat syarikat adalah serupa.

Dalam analisis selanjutnya, kajian ini menjalankan model regresi linear. Model ini menunjukkan corak linear meningkatkan keputusan beban apabila kawalan struktur meningkat. Model global membentangkan model yang lebih baik untuk memahami tingkah laku mereka dalam membuat keputusan.

Model global menjelaskan bahawa lapan syarikat berserakan dan tidak cenderung kepada identiti pemilikan mereka. Tiga kumpulan yang muncul, Boustead berada dalam Kumpulan 1, Sime Darby, KLK, IOI Corp, IJM Plantations, dan Genting Plantations berada dalam Kumpulan 2, dan Jaya Tiasa dan Kulim berada dalam Kumpulan 3. Pengumpulan menunjukkan kesamaan mereka dalam corak tingkah laku membuat keputusan . Walau bagaimanapun, setiap syarikat berbeza dari segi beban keputusan yang diberikan kawalan struktur anak syarikat yang sama dan sebaliknya. Walaupun syarikat itu tergolong dalam kumpulan yang sama, mengikuti corak linear yang sama yang semakin meningkat keputusan apabila kawalan struktur meningkat, beban keputusan mereka semua berbeza dengan kawalan struktur yang sama.

Terdapat tingkah laku yang muncul dari pemintas beban keputusan dan hubungan kawalan struktur. Kajian ini menganggap kelakuan sebagai fleksibiliti struktur. Kelenturan struktur syarikat sangat bergantung kepada bilangan syarikat, indeks hierarki, dan saiz piramid.

Berdasarkan hasilnya, analisis menunjukkan bahawa setiap syarikat, sama ada GLC atau perusahaan milik keluarga, berfungsi secara berbeza. Tingkah laku pengambilan keputusan mereka kurang bergantung pada jenis pemilikan dan lebih banyak pada topologi atau reka bentuk struktur, seperti bilangan syarikat, indeks hierarki, dan saiz piramid. Tahap keputusan dan kawalan yang berbeza menunjukkan pelbagai corak fleksibiliti.

Analisisnya membuktikan bahawa struktur pemilikan syarikat mempengaruhi tingkah laku mereka membuat keputusan. Kajian ini menyimpulkan bahawa tingkah laku mereka membuat keputusan kurang bergantung pada jenis pemilikan dan lebih banyak pada topologi atau reka bentuk struktur pemilikan. Kedua-dua GLC dan FOB mempunyai persamaan dan perbezaan dalam tingkah laku mereka membuat keputusan. Hasilnya mungkin bertentangan dengan beberapa kajian lain dan ia membuka bidang penyelidikan dan analisis baru korporat, tanpa mengira jenis / identiti pemilikan mereka (milik kerajaan atau milik keluarga). Kaedah ini membolehkan kami menilai struktur topologi pemilikan secara kuantitatif dan kualitatif. Selain itu, syarikat-syarikat ini boleh dinilai berdasarkan analisis yang digunakan dalam kajian ini.

ACKNOWLEDGEMENTS

First and foremost, I would like to thank God Almighty for giving me the strength, knowledge, ability and opportunity to undertake this research and to persevere, and complete it satisfactorily. Without his blessings, I would not be able to achieve this to the best of my ability.

Secondly, this journey would not have been possible without the support of my family. Hence, I would like to thank my wonderful parents and parents-in-law, who have continuously supported me; my dearest husband, Kiwi, who has always been there for me and has guided me all the way and my loving children, who have always inspired me to be better. I am grateful for their unconditional love.

Next, I would like to express my sincere gratitude to my advisor, Dr Jean-Marc Roda for his continuous support, patience, motivation, and knowledge during my PhD studies. His guidance has indeed been valuable especially during the time when I did my research and wrote this dissertation. I could not have imagined having a better advisor and mentor for my PhD studies.

Besides Dr Roda, I would like to thank Prof. Dr Terence Gomez for his encouragement, knowledge and experience in the area of political business. It is an honour to work with him during my PhD journey. My sincere thanks also to the rest of my supervisory committee members, Dr Shaufique Fahmi Ahmad Siddique and Prof. Dr Paridah Md. Tahir, for their insightful comments and inspiration, and also for the hard questions which encouraged me to widen my research from various perspectives.

My sincere thanks to the interns, Raphael, Omar, Valentin, Jean-Eudes, and others who worked under the supervision of Dr Roda. I would like to express my deep appreciation to my colleagues in Universiti Malaya, Trishi, Fikri, Sunil, Wai, and others for our stimulating discussions, the hours we spent working together, the constructive reviews of my dissertation, and all the fun we had together. Thank you also to Yagnesh, Uni, and Ivan who have helped me in the re-construction and editing of my dissertation.

I would also like to thank my colleagues in UPM who have helped me in this research and have provided me the opportunities to learn from them. Lastly, I would like to express my heartfelt gratitude to my best friends who have in their own ways, kept me going on this challenging journey, assisted me to the best of their ability and ensured that our friendship remained strong to this very day.

I certify that a Thesis Examination Committee has met on 8 October 2018 to conduct the final examination of Norfaryanti Binti Kamaruddin on her thesis entitled “Ownership network structure and decision-making behaviour of eight major oil palm companies in Malaysia” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Doctor of Philosophy.

Members of the Thesis Examination Committee were as follows:

Ahmad Ainuddin Nuruddin, PhD
Professor
Faculty of Forestry
Universiti Putra Malaysia
(Chairman)

Hishamuddin Zainuddin, PhD
Associate Professor
Faculty of Science
Universiti Putra Malaysia
(Internal Examiner)

Bany Ariffin Md Amin Noordin, PhD
Associate Professor
Faculty of Economics and Management
Universiti Putra Malaysia
Internal Examiner)

Philippe Cadene, PhD
Professor
Centre d'études en sciences sociales sur les mondes africains, américains et asiatiques (CESSMA)
Paris Diderot University
France
(External Examiner)

_____
Rusli Abdullah, PhD
Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia
Date: 17 December 2018

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

Jean-Marc Roda, PhD
Research Fellow
Institute of Tropical Forestry and Forest Products
Universiti Putra Malaysia
(Chairman)

Paridah Md. Tahir, PhD
Professor/Director
Faculty of Forestry
Universiti Putra Malaysia
(Member)

Shaufique Fahmi Ahmad Sidique, PhD
Associate Professor/Director
Faculty of Economics and Management
Universiti Putra Malaysia
(Member)

Edmund Terence Gomez, PhD
Professor
Faculty of Economics and Administration
Universiti Malaya
(Member)

_____
ROBIAH BINTI YUNUS, PhD
Professor and Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

ASNB	Amanah Saham Nasional Berhad
Bhd	Berhad
BoD	Board of directors
CCM	Companies Commission of Malaysia
CEB	Corporate-environmental behaviour
CEO	Chief executive officer
COEs	Collectively-owned enterprises
CPKO	Crude palm kernel oil
CPO	Crude palm oil
E&O	Eastern and Oriental Berhad
FFB	Fresh fruit bunch
FOBs	Family-owned businesses
GLCs	Government-linked companies
GLICs	Government-linked investment companies
IGB	IGB Corporation Berhad
IOI Corp	IOI Corporations Berhad
Johor Corp	Johor Corporation Berhad
KLK	Kuala Lumpur Kepong Berhad
KLSE	Kuala Lumpur Stock Exchange
KWAP	Kumpulan Wang Persaraan (Diperbadankan) (Retirement Fund Incorporated)
LTAT	Lembaga Tabung Angkatan Tentera (Armed Forces Savings Fund)
M-form	Multidivisional corporation
MNCs	Multinational corporations

CHAPTER 1

INTRODUCTION

1.1 Problem Statement

What shapes a company's decision-making? Does it depend on the owner's identity or the company's structure? Why is it important to understand the company's decision-making behaviour? These are the questions that opened the path for this research.

In the literature, the common idea is ownership and control depend on who the owner is. There are three main identities of an owner in a firm: government, family and private. It is believed that decision-making in government-owned companies is determined by political influence. Meanwhile, decisions in family-owned companies rely heavily on aspirations of the founder, while those of private companies are controlled by professionals who make decisions based on facts and figures.

However, while the owner may influence decision-making control of a firm, the ownership structure may have equal or even more influence. The ownership structure of a business involves a multitude of shareholding relations among stakeholders. The stakeholders vary from individuals, government and financial institutions. Among these stakeholders, one will have significant ownership of the business. As the structure of a company grows more complex, the power and control flow from the ultimate shareholder may be concealed and identifying the actual controller of decisions becomes more difficult. Cross-shareholdings and a pyramidal structure play important roles in transferring information when making decisions. An assessment of cross-shareholdings can reveal the amount of control held by a company/individual in a structure, where they own each other but have different amounts of control. For example, company A owns company B by 51%, while company B owns company A by 10%, but these interlocking shareholdings may hide the identity of the actual controller of decisions. The pyramidal structure reflects the hierarchical level of information flow in decision-making. The more pyramidal the company, the bigger the flow of information, a factor that can result in inflexibility in the decision-making process.

Given that the ownership structure of companies involved in diversified business activities vary, it is crucial to analyse them in a greater detail, to gain a better understanding of their decision-making behaviour. Generally, when the behaviour is better understood, the policy intervention is better designed.

The agribusiness and plantations sector is the focus of this research. Agribusiness and plantations are the leading agents in Malaysia's agriculture

industry. The oil palm industry constitutes most of the agribusiness and plantations sector and is the major contributor to the gross domestic product (GDP) in the agriculture sector. In 2016, the oil palm industry contributed 43 percent to the sector, compared to forestry logging and rubber that only contributed 7 percent respectively (Department of Statistics, 2017).

Agribusiness and plantation companies face the dilemma of balancing financial growth and environmental sustainability. They need to achieve financial growth to satisfy shareholders' return on investment, and at the same time, they have to manage trading and investment responsibly to sustain the environment for the future. For government-linked companies (GLCs), there is another dilemma which is to fulfil their social obligations. They have to adhere to the ruling government's visions and aspirations which highly depend on the political agenda. How well they carry out these responsibilities depends on their ability to make responsible decisions. For that reason, it is vital to understand the decision-making behaviour of companies in this sector.

The global agriculture sector is in the process of financialisation, a process in which the role of financial institutions as shareholders is becoming more prevalent. The increasing amount of investment by leading agribusiness corporations is one of the drivers of this process (Anseeuw, Jean-Marc, Antoine, & Norfaryanti, 2016). Financialisation has increased the complexity of the ownership structure of these firms, including those owned by the government, families or private individuals. These companies, regardless of who the owners are, possibly have more complex structures, i.e. interlocking shareholdings and pyramiding. The core questions of this study are: how do complex shareholding structures shape decision-making among government- and family-owned companies in this sector? Is it true, as the current literature suggests, that their decision-making mechanisms are still controlled by their ultimate owners? Are there significant differences in the decision-making processes of government- and family-owned companies?

1.2 The Research Gap

The relationship between companies' ownership structure and decision-making behaviour among agribusiness corporations has not yet been clarified. The use of network analysis to explore this relationship is also lacking. Therefore, this research fills the gap by analysing quantitatively and qualitatively the oil palm plantation corporations' ownership structure to explore its relationship with decision-making behaviour.

The ownership structure of a company has a crucial bearing on its corporate strategies (Chandler, 1962; Miles, Snow, Meyer, & Coleman, 1978). The ownership structures of large corporations are complex and diverse which informs their decision-making behaviour. Decision-making control by a corporate entity is complex because of the convoluted shareholding structures within the

company. The ownership structures that can be employed include cross-shareholdings and pyramidal structures that can contribute to the complexity of the decision-making process. Such structures could also lead to devious decision-making.

Government-linked companies (GLCs) and family-owned businesses (FOBs) are seen to be fundamentally different in terms of the nature of their ownership which, in turn, determines their decision-making control mechanisms. This issue has become more pertinent now that ownership structures of major corporations have become extremely complex in the context of growing corporation size and intense competition. In the palm oil, forestry and biomass sectors, both GLCs and FOBs are big businesses that have contributed significantly to the development of these sectors.

Control of decision-making in the corporation is vital. It leads to many implications. Excellent control will allow the corporation to prosper; bad control will devalue the corporation. Excellent control includes good governance in the decision-making process where the decisions made are legitimate and with high integrity. Weak control in decision-making encompasses conflicts-of-interest, no integrity, and inappropriate corporate activities.

The board of directors and the management team are key actors in the decision-making structure. They belong to the hierarchical managerial decision-making structure, also regarded as the power structure (Martz & Semple, 1985). Each hierarchy level has a range of control in the decision-making, and it carries a decision's load. For example, a business development department has its hierarchy levels which are responsible for making decisions on future investment of the company. These decisions have a load in the hierarchy. The decisions load in the hierarchy somewhat reflects the decision-making behaviour of the company.

Connections in the structure convey the flow and the concentration of corporate control as well as the flow of information. High concentration of ownership of shares reflects high influence over decision-making.

In the agribusiness and plantation sectors, the decisions of a company are often directly related to environmental sustainability. These important sectors also recorded high volumes of trade and investment in the country and the region. Most of the time, it is difficult to decipher a decision made by a company because many aspects could drive decision-making, from political intervention, oil prices and environmental issues, to international trade and global financial market trends. Understanding the reason for decision-making by a company, be it to reinforce control patterns or other factors, is crucial as this provides insights into issues such as the sustainability of the agricultural sector worldwide. This research is designed to understand and analyse the decision-making patterns by major agribusiness and plantation companies in Malaysia.

GLCs and FOBs are big businesses that have contributed significantly to the development of these sectors but are seen to be fundamentally different regarding how their ownership structure patterns determine decision-making control. As the structure of a company grows more complex, the power and control flows from the ultimate shareholder may be hidden and identifying the actual controller of the decisions becomes more difficult.

1.2.1 Logical Framework

As indicated in the logical framework of this research in Figure 1.1, every structure has properties and a purpose. Structural theories established in the field of science, especially in chemistry, where it was developed stress this point. In the disciplines of business and economics, Chandler (1962) has set the ground for this research. According to him, organisational structure determines corporate strategy. Decision-making is part of corporate strategies. The decision-making is shaped by interactions between actors in the organisation. GLCs and FOBs have diverse actors with various objectives. The interactions among the actors are derived from the design of the ownership and control of the company. The design or the composition of the ownership and control shapes the company structure, reciprocally.

Most of the ownership structures of companies are becoming complex networks. With the advancement of network studies, network analysis is emerging as an important tool to understand the interactions between actors in complex networks. Complex networks are present in a wide range of systems in nature and society, such as in the Internet, movie actor collaborations, cellular networks, ecological networks, citation networks, linguistics networks, power and neural networks, financial networks and many others (Albert & Barabasi, 2002).

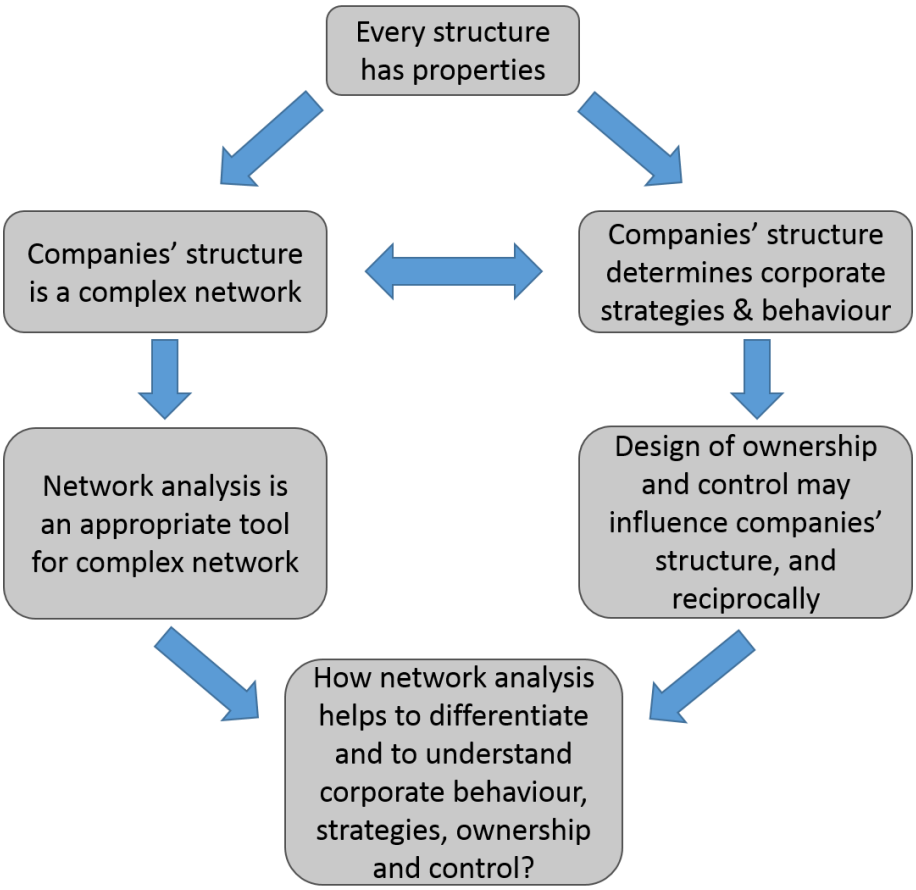

Figure 1.1: Logical framework of the research

A company's structure determines its corporate behaviour and it can emerge as a complex structure, leading to why network analysis serves as a tool to link corporate strategies, ownership and control. This logical framework is the basis for the theoretical framework which will be discussed in the following chapter.

Due to the complex corporate structure which informs decision-making influence, this research is designed to quantify and analyse the decision-making behaviour of each firm based on its corporate structure using network analysis tools. As mentioned, network analysis is emerging as a tool to analyse a complex network such as the shareholding structures of large companies. A decade ago, the tools used to analyse a complex network were limited. Over time, these tools have evolved and network analysis is able to uncover complex cross-shareholdings and pyramidal structures in a quantitative manner.

1.3 Scope of the Research

This research is part of a bigger project under the Consultative Group on International Agricultural Research (CGIAR). Research Programme 6 (CRP6) focused on forests, trees and agroforestry. It is funded by a partnership with various international agroforestry institutions, such as the Center for International Forestry Research (CIFOR), World Agroforestry Centre, International Center for Tropical Agriculture and others. One objective of CRP6 is to study the impact of trade and investment on forests and people, particularly the effects of financialisation on the agriculture sector.

To understand the impact of forest-related trade and investment in Southeast Asia, this research decided to focus on agribusiness and oil palm plantation companies, where most of the trade and investment in forest-related activities were recorded. The leading agribusiness and oil palm plantation companies are part of the financialisation of the global agriculture sector. This research analysed eight companies among the top 12 companies listed in Table 1.1. These eight companies are global players in the industry. As of 2013, there were 44 agribusiness and plantation corporations listed on the Bursa Kuala Lumpur (Table 1.1). Their market capitalisation was then RM172 billion, 10% of the total market capital value of the Bursa Kuala Lumpur which was RM1.7 trillion (Gomez, Padmanabhan, Kamaruddin, Bhalla, & Fisal, 2017).

Table 1.1: Agribusiness and plantation corporations listed in Bursa Kuala Lumpur in 2013

No.	Plantation corporations	Market capital (RM billion)	Ownership type	Estimated planted area (ha)
1.	Sime Darby Berhad	57.5	Federal GLC	525,000
2.	IOI Corporation	30.0	Family	175,000
3.	Kuala Lumpur Kepong Berhad (KLK)	23.5	Family	193,000
4.	Batu Kawan Berhad	8.518	Family	
5.	Genting Plantations	7.759	Family	117,000
6.	United Plantations	5.707	Family	50,000
7.	Kulim (M) Berhad	4.259	State GLC	50,000
8.	TSH Resources	2.919	Family	50,000

9.	IJM Plantations Berhad	2.882	Federal GLC	55,389
10.	Sarawak Oil Palms Berhad	2.628	Family	63,530
11.	Boustead Holdings Berhad (Boustead)	2.544	Federal GLC	70,338
12.	Jaya Tiasa Holdings	2.064	Family	62,745
13.	Hap Seng Plantations Holdings	2.024	Private	35,697
14.	TH Plantations	1.644	Federal GLC	60,270
15.	MKH Plantations	1.497	Private	14,400
16.	Ta Ann Holdings Berhad	1.464	Private	36,944
17.	United Malacca Berhad	1.456	Family	22,336
18.	TDM Berhad	1.415	State GLC	44,000
19.	Far East Holdings Berhad	1.067	State GLC	20,768
20.	Kretam Holdings	0.95	Private	19,842
21.	Rimbunan Sawit Berhad	0.94	Family	54,659
22.	Chin Tek Plantations Bhd	0.88	Family	10,925
23.	Kim Loong Resources Bhd	0.84	Family	23,512
24.	Tanah Makmur Berhad	0.79	Private	17,969
25.	BLD Plantation	0.78	Private	27,300
26.	Sarawak Plantation Berhad	0.70	Private	31,266
27.	Kwantas Corporation Bhd	0.66	Family	17,051
28.	WTK Holdings Berhad	0.61	Private	9,000
29.	Dutaland Berhad	0.51	Family	10,557
30.	PLS Plantation	0.47	Private	12,140
31.	Negri Sembilan Oil Palms Bhd	0.40	Family	2,653
32.	Inch Kenneth Kajang Rubber PLC	0.36	Private	189
33.	NPC Resources Bhd	0.33	Private	17,316

34.	Cepatwawasan Group Berhad	0.31	Family	11,331
35.	Golden Land Berhad	0.28	Family	9,414
36.	Riverview Rubber Estates Bhd	0.28	Private	2,583
37.	Sungei Bagan Rubber Co (M) Bhd	0.24	Family	2,615
38.	Kluang Rubber Co (M) Bhd	0.23	Family	1,574
39.	Harn Len Corporation Bhd	0.21	Family	12,751
40.	MHC Plantations Berhad	0.21	Family	na
41.	Gopeng Berhad	0.15	Private	1,434
42.	Astral Asia Berhad	0.14	Private	4,019
43.	Malpac Holdings Bhd	0.14	Private	2,023
44.	Pinehill Pacific Berhad	0.06	Private	11,658
	Total	**172.325**		

Sources: *2013 Companies' Annual Report*, *2013 Stock Performance Guide*, *and www.malaysiastock.biz*

Most of the big corporations were founded during the British colonial era. They started as rubber plantation companies and evolved into palm oil businesses between the 1960s and 1970s. As modernisation of the agriculture sector occurred, many of these corporations became involved in a diverse range of business activities, including property development, product manufacturing, heavy machinery and motor production.

Based on Table 1.1, most of the public-listed companies (21 companies) in the plantation sector are family-owned. In the top ten, seven are family-owned businesses. In 2013, total market capital value for family-owned business in the plantation sector was RM90 billion, constituting 52% of the total plantation sector. The rests are either private companies (15) or GLCs (8).

Among GLCs, there are four federal GLCs and three state GLCs. Entities under the federal government which owned plantation companies are Permodalan Nasional Berhad (PNB), Lembaga Tabung Angkatan Tentera (LTAT), and Lembaga Tabung Haji (LTH). State government entities which owned plantation companies are Johor Corporation, Terengganu Incorporated Sdn Bhd, and Lembaga Kemajuan Perusahaan Pertanian Negeri Pahang. The total market capital of GLCs in 2013 was RM71 billion, 41% of the total plantation sector. The

private companies are owned by private limited companies or individuals, which are neither government- nor family-owned.

Out of 44 companies, this research analysed eight companies in the top 12, of which four are GLCs and four are FOBs. The GLCs are Sime Darby Berhad, Boustead Holdings Berhad, IJM Plantations and Kulim Berhad. The FOBs are IOI Corporations Berhad, Kuala Lumpur Kepong Berhad, Genting Plantations Berhad and Jaya Tiasa Berhad. They are major agribusiness and plantation players in Southeast Asia and the world, contributing about 50% of the total plantations market capital and land bank area.

1.3.1 Research Questions

Based on the problem highlighted earlier, several questions are raised to achieve the overall objective of the research. The research questions are:

i. How to best describe the ownership structure of the corporations and link to decision-control behaviour?
ii. Are the GLCs and FOBs ownership structures similar or different?
iii. Is there a general criteria to link to the decision-control behaviour?
iv. Can decision-control behaviour be represented by a mathematical relationship?

1.3.2 Hypotheses

This research is to test these hypotheses:

1. Ownership structures of government-owned and family-owned companies in agribusiness and plantations are different.
2. The differences or similarities in the ownership structure affect decision-control, involving enterprise development.

1.3.3 Objectives of the Research

The overall objective of this study is to analyse the links between the ownership structure and the corporate decision-making control behaviour. The specific objectives are to:

i) understand and analyse how the shareholding structure shapes decision-control behaviour of agribusiness corporations owned by the government and families;
ii) understand and analyse decision-control patterns by GLCs and FOBs; and

iii) investigate if there is ownership structure criteria to explain decision-control behaviour (model).

1.3.4 Using the Emerging Network Analysis Tool

Due to the complex corporate structure which informs decision-making, this research is designed to quantify and analyse the decision-making behaviour of each firm based on its corporate structure using network analysis tools.

Network analysis is emerging as a tool to analyse complex networks such as the ecological network, financial network, and others. The shareholding structures of large companies are such complex networks. This research employed a network analysis tool which can quantify the decisions load on the corporate structure. Besides, the tool provides insights into the corporate structure which was not discovered in any study previously. A decade ago, the tools used to analyse a complex network were limited. Over time, these tools have evolved, and network analysis can uncover complex cross-shareholdings and pyramidal structures quantitatively.

1.4 Significance of the Study

The study of the ownership and control networks in the agribusiness sector can be a learning paradigm in agribusiness study, as well as to enhance multidisciplinary research. Many studies on decision sciences did not assess decision-making patterns employing the methods used here.

This study's goal is to expand the understanding of what shapes a company's decision-making, using a mixed method approach. The literature is mainly either quantitative or qualitative in its approach. Very few studies employed a mixed method and none focussed on agribusiness and networks, analysing and comparing decision-making behaviour of GLCs and FOBs.

1.5 Thesis Organisation

The first chapter discusses the problems and the scope of this study. It also includes an overview of the agribusiness and plantation sector in Malaysia, as it is the dataset used in this study. The objectives and a logical framework are included in this chapter. These elements framed the research questions and the hypotheses.

Chapter two reviews and analyses the relevant theories and concepts of ownership structure. It also reviews publications related to the topic of corporations' decision-making behaviour and network analysis.

The third chapter explains in detail the methodology used to achieve the objectives of the study. It also discusses the data collection and data analysis. It explains the theory and the application of network analysis in the context of network centralities metrics and statistical method.

The fourth chapter covers the results and discussions of the network analysis. It includes network topology and the network features for each company by ownership identity, i.e. either GLC or FOB.

Chapter five provides the results and discussions of the network centrality metrics. This chapter covers the linear regression analysis.

The sixth chapter concludes the thesis by summarising the findings that are related to the problems identified earlier. It presents the significant findings, limitations of the study as well as the implications of this study at the micro and macro levels.

CHAPTER 2

THEORETICAL AND EMPIRICAL REVIEWS

This study analyses the impact of ownership and control structure, based on the decision-making behaviour. This chapter reviews studies that have discussed this topic as well as theories related to ownership and control, corporate behaviour, and graph theory. The ownership and control concepts are used in this research to analyse decision-making behaviour of state and family-owned firms. Graph theory induces network analysis which can quantify decision-making behaviour, based on these firms' ownership and control structure.

The first section of this chapter defines the key terms used in this study. These terms are used in many studies, and some studies may define them differently from how they are defined in this research.

The second section presents the theoretical framework of this research. The remaining three sections review studies that discuss the influence of the ownership and control structure on decision-making behaviour, the ownership and control of GLCs and FOBs, and network theory and their application in similar fields of studies, such as financial power network, shareholdings and board of directors' networks, and interlocking directorships between firms.

2.1 Review of Definitions

This section reviews the key terms and definitions used in this research. The key terms used are varied across disciplines. There are nine key terms employed here which are ownership structure, ownership and control, decision-making control, ownership identity/type, government-linked companies (GLCs), family-owned businesses (FoBs), agribusiness and plantations, complex network, and centralities measures.

Ownership structure

The term ownership structure in this study refers to the form, topology and pattern of shareholding within companies and their subsidiaries, as well as their associate companies. It also refers to the position of any group of firms in relation to their controlling shareholders (Almeida, Park, Subrahmanyam, & Wolfenzon, 2008). This research subscribed to this definition.

However, there are other definitions of ownership structure, one of which is defined as ownership concentration, taking into account ownership share of the

most substantial owner (Amihud & Lev, 1999; Bunkanwanicha, Gupta, & Wiwattanakantang, 2016; Cull, Matesova, & Shirley, 2001; Daily & Dollinger, 1992; Demsetz, 1983; Denis, Denis, & Sarin, 1997; Ghazali, 2007; Hill & Snell, 1989; Laeven & Levine, 2008; Leech & Leahy, 1991; Lim, 2012; Moebert & Tydecks, 2007; Prowse, 1992; Sharifi, 2014; Su, 2010; Thomson & Pedersen, 2000; Zhao, 2010) or a fraction of the equity held (Jensen & Meckling, 1976). The definition is common but this research does not refer to this meaning.

There are two types of ownership structures that are observed in this research: pyramidal and cross-shareholdings structures. Companies with a pyramidal structure are those whose ultimate owner creates a chain of ownership that allows the owner to control some firms, even the ones in which the owner has no direct ownership. The dominant owner in this structure is, therefore, one wealthy entity. In this type of structure, a top-down chain of control is displayed; the one that sits at the apex is the ultimate owner and followed by layers of firms (La Porta, Lopez-De-Silanes, & Shleifer, 1999). Indirect ownership in this structure serves as a means to maintain control over a large group of companies (Bertrand & Mullainathan, 2003).

In other structures, when the businesses grow and the number of companies at the lower pyramid increases, the apex may lose the concentration of control (Ariffin, 2009). However, a pyramidal structure allows the apex to retain control of many firms despite the growth of the business. In that way, a pyramidal structure facilitates efficient channelling of resources (Bunkanwanicha et al., 2016). Pyramidal structures are employed by both government-owned and family-owned companies.

Cross-shareholding

Cross-shareholding is a control structure where the firm owns shares in another company along the firm's chain of control (La Porta et al, 1999; Villalonga & Amit, 2006). For example, firm A owns 15 percent shares in its shareholder firm B, and firm B owns 25 percent shares in firm A. However, this situation is not limited to family-owned businesses. It differs from a pyramid where the control of a group remains more distributed than concentrated. In complex ownership groups, cross-ownership structures or circular ownership patterns are hardly detectable (Bebchuk, Kraakman, & Triantis, 2000).

Ownership and control

Control is defined by Chandler (1977) as the ability to decide the "basic long-term goals and objectives of the enterprise and the adoption of courses of action and the allocation of resources necessary for carrying out these goals". Control can be exercised in two forms, i.e. ownership and authority (Fligstein, 2001). Government as the owner would practice both forms of control as they have the ultimate authority. As for the family and private owner, this ownership form of control is common. Berle and Means (1932) highlighted that in an enterprise with

a large capital base, such as publicly-listed firms, a mere 10 percent equity ownership is sufficient to maintain control. The government, as the owner of companies, can exercise control in both forms, as they can own the companies and have authority over them. Meanwhile, the family and private owner can only exercise control by ownership.

When deciding on strategies and size, firms have three dimensions of control: operating controls, market controls and strategic controls (Hill, 1988). Operating controls reflect control over operating functions, i.e. marketing, manufacturing, purchasing. Market controls are related to control in the sub-unit of the business or the subsidiaries in achieving their business performance indicator. Strategic controls are dimensions of control that allow firms to determine their directions and align them with the external and global situation.

This study focuses on the last dimension. It should be noted that strategic control is associated with control over the company structure. If control over the structure of the company is efficient, so is its strategic control.

The focus of this study is also on how strategic control is associated with structural control. Strategic control involves determining the direction of a corporation and aligning it with both external and global situations. Besides determining and aligning these corporate directions, the structure functions as the backbone. If structural control of a corporation is efficient, strategic control of decisions should fit in well.

Decision-making control

Decision-making control involves a substantial degree of influence over strategic choices (Dean & Sharfman, 1996; Child, 1972; Miles, 1982). Some of the literature refers to this term as strategic planning (Ramanujam, Venkatraman, & Camilus, 1986; Robinson & Pearce, 1983). This research applies this definition.

Decision-making is hierarchical and as the organisation becomes more complex and diversified, control and decision-makers become separated (Daniels, 1983). When there is a large number of companies, the volume of control from the decision-makers increases, but engagement between the top and bottom in the hierarchy is less and separated.

Decision-making is based on goals or values and facts, as well as inferences based on goals and facts. The goals and values may be simple or complex, consistent or contradicting; facts may be real or assumptions, based on various sources; the inferences may be valid or invalid. These processes, referred to as ‘reasoning’, should support the decisions (Simon, 1959).

The importance of ownership and control of a corporation justifies the decision-making power, where the power resides in the voting shares (Martz & Semple, 1985). The higher the shareholding, the stronger the power in decision-making.

Network mechanisms shape organisational decision-making, depending on the mix of partners and activities in the structure (Owen-Smith, Cotton-Nessler, & Buhr, 2015). It contributes to the flow of interactions among various agents in the organisation. This is the point why this research applied network analysis as the method.

In corporate environmental behaviour (CEB), a firm's internal characteristics are crucial in delivering the responsible environmental outcome. These characteristics include their corporate structure. The firm's characteristics is also referred to as firm capability (Sarkar, 2008). This research believes that firm capability is a reflection of its corporate structure.

Ownership identity/type

The term ownership identity or ownership type refers to who is the owner or major shareholder of the firm. Based on the identity, the firms studied in this research are divided into three categories; government-linked companies or state-owned enterprises (GLCs/SOEs), family-owned businesses (FOBs) and private businesses. Categories highlighted in other studies include widely-held financial institutions, widely-held corporations, cooperatives, and voting trust (La Porta et al., 1999; Laeven & Levine, 2008). In Asia, state-owned enterprises refer to government-linked-companies (GLCs) (Ang & Ding, 2006; Gomez, Padmanabhan, Kamaruddin, Bhalla, & Fisal, 2017). The data in this research are analysed according to this categorisation.

Other categorisations exist, but are not relevant to this research. It includes state asset management bureaus, state-owned enterprises (SOEs) affiliated to the central government, SOEs affiliated to the local government, and private investors (Chen et al. 2009; Lu & Yao, 2006). Regarding SOEs, other ownership types comprise collectively-owned enterprises (COEs), and township and village enterprises (TVEs) (Lane, Cannella, & Lubatkin, 1998). Some studies may define private owners as among the non-state, insiders are related to workers and managers, and outsiders are referred to as domestic individuals, legal entities, and foreign owners (Sprenger, 2007; Ferreira, Ornelas, & Turner, 2007).

Government-linked companies

This research uses the Organisation for Economic Co-operation and Development (OECD)'s definition of *government-linked-companies (GLCs)* which is:

> "…companies that have primary commercial objective and in which the Malaysian government has a direct controlling stake, i.e. the ability to appoint board members and senior management, make major decisions (e.g. contract awards, strategy, restructuring and financing, acquisitions and divestments) for GLCs either directly or through government-linked investment companies (GLICs). Hence, GLCs include companies where the government controls directly or collectively a controlling stake through state agencies… (and) includes companies where GLC themselves have a controlling stake, i.e. subsidiaries and affiliates of GLCs." (OECD, 2013)

This definition is consistent with that adopted by the World Bank. In its report, the World Bank defines GLCs as "companies where the government controls directly or collectively a controlling stake through state agencies" (World Bank, 2012).

Based on the definitions by the OECD and the World Bank, this research defines GLCs as companies that are under the majority ownership of the federal or state government. Majority ownership means 20 percent or more of a company's equity ownership by one or several federal or state government entities.

Family-owned businesses

Family-owned businesses (FOBs) are businesses that are owned by a single individual – the owner-operator – who can accurately assess the firm's processes; they are usually small firms (Churchill & Hatten, 1987; Daily & Dollinger, 1992). A family business is a system that includes the business, the family, the founder, and the board of directors (Beckhard & Dyer, 1983). They are governed and managed to shape and pursue the vision of the business held by a dominant coalition that is controlled by members of the same family or a small number of families. These businesses are potentially to be passed across generations of the family (Chua, Chrisman, & Sharma, 1999). The ownership structure of FOBs is usually pyramidal (Almeida & Wolfenzon, 2006).

Other definitions of FOBs also involve family participation, and where the family has control over strategic decisions (Miller & Rice, 1967). The founder or his/her descendants run the company, with the intention of keeping the company within family control. FOBs have multiple generations of the family who are involved in the running of the firm, and some of these family members have managerial responsibilities (Sharma, Chrisman, & Chua, 1997; Astrachan & Shanker, 2003; Zahra, Hayton, and Salvato, 2004). These definitions matched the scope for family-owned businesses for this research.

FOBs are also defined as "a public or private company in which a family (or related families) controls the largest block of shares, has one or more of its

members in key management positions, and members of more than one generation are actively involved within the business" (Miller & LeBreton-Miller, 2005). In this research, family-owned businesses are defined as a firm in which the substantial shareholders are family-related and managed by family members. There is no one definition fits all, so in this research, an integration of all these definitions is used for FOBs.

Agribusiness and plantations

Agribusiness refers to business operations involved in the manufacturing and the distribution of farm supplies; production operations on the farm; and the storage, processing, and distribution of farm commodities and items made from them (Davis and Goldberg, 1957).

Research on agribusiness sectors focuses on two major topics; the coordination of participants within the food chain, known as agribusiness economics, and the study of decision-making within the food chain governance structures, known as agribusiness management. This study will focus on the latter.

The term plantation in this study is understood as the cultivation of a limited number of crops. Plantation crops are perennial trees or shrub crops, such as tea, coffee, cocoa, oil palm, citrus, banana, rubber, coconuts, and certain field crops such as pineapples, sisal and sugar. Most of the plantations occupy land for more than six months. It is identified as the specific type of large farm. This research focuses on oil palm plantation.

There are different opinions on the minimum size of land. The Plantations Convention in 1958 considered an estate that is larger than 5 hectares as a plantation. Malaysia and some other countries define plantation, by law, as having more than 40 hectares. There are three types of plantations: smallholdings, less than 10 hectares; small plantations, family-owned or small companies, at 10 to 500 hectares; large plantations, from 100 to thousands of hectares which are typically owned by the large national companies or state organisations (Tiffen & Mortimore, 1990).

A plantation in this research, however, is not just a large farm. It should have integrated agricultural activities which require high capital-to-land ratio and includes research and development activities.

Complex network

A network is a set of items: nodes or vertices, and edges or links. The nodes represent the agents or actors of the network. The links represent the interactions between the actors. The analysis of networks is driven by the increasing availability of an enormous amount of data in the various fields of

research, such as neurobiology, genomics, ecology, finance, and many others. The advancement of computer tools and mathematics drives network analysis as an essential tool to uncover the behaviour of complex systems.

A complex network consists of a class of networks or many interacting/interconnected parts (Glattfelder, 2010) which specify a structural feature by its connectivity and influences the dynamics of the interactions or processes in the networks (da Costa, Rodrigues, Travieso, & Villas Boas, 2007; Glattfelder, 2010). *A* complex network is described as a wide range of systems in nature and society. Among real life networks found empirically are the worldwide web, Internet, scientific collaborations, cellular networks, ecological networks, citation networks, linguistics networks, power and neural networks, protein folding, and financial networks (Albert & Barabasi, 2002). Natural, social and technological systems which show intricate patterns of connectivity between their units are also described as complex networks (Newman & Park 2003; Boccaletti, Latora, Moreno, Chavez, & Hwang, 2006).

Back in the 1930s, sociologists realised the importance of connection between people to understand human society. Typical social network studies address issues of which individuals are best connected to others, or have the most influence, and how individuals are connected to one another through the network (Newman, 2001). Researchers in recent years developed a variety of techniques to understand the behaviour of these systems (Newman, Watts, & Strogatz, 2002). The approach behind these complex networks is similar and based on graph theory.

Centrality measures/Network metrics

Centrality measures serve to quantify the nodes or links that are more crucial than others in the network (Koschutzki et al., 2005). Many types of such measures were introduced in the 1950s. These early discoveries opened the research path. Centrality can also be referred to as ‘influence’, or ‘control’, depending on the perspective of the networks. For example, a node can be regarded as central or influential if it is heavily required for the information transfer within the network (Koschutzki et al., 2005). The links or edges can be regarded as the lines to transfer the information. In this research, a node refers to a company or the individual who holds shares in the business. The weights are the percentage of the shareholding by the company or the individual.

Centrality can be quantified as index/metric which is also referred to as the network structural index/metric. Here, it is referred to network metrics. These centrality metrics provide various perspectives to assess the network.

Network metrics can be grouped based on the centrality classes. There are seven main network centrality classes, such as, distance and neighbourhoods, shortest paths, derived edge centralities, vitality, current flow, random

processes, and feedback (Koschutzki et al., 2005). The centrality classes are the network perspectives which quantified the links and interactions. Not every network centrality metrics are suitable for every application.

This research deals with business decision-making control in large public-listed firms. The aim is to quantify and qualify the decision-making behaviour of the industry players. *Betweenness* and *stress* are selected as the primary centrality metrics in this research. It belongs to the centrality class shortest paths which will help the researcher to understand decision-making behaviour based on the interactions between companies in the network.

Betweenness and stress are the (relative) number of shortest paths that contain the central nodes or/and edges (Koschutzki et al., 2005). Stress was introduced by Alfonso Shimbel in 1953. It referred to the 'work' done by each node in a communication network. Since then, stress is used to quantify the various links of communication paths. Stress is counting the absolute number of shortest paths in the network. This research represents stress as the decisions load in the companies.

Betweenness can be viewed as a relative of stress centrality. It was introduced by Jacob Anthonisse in 1971 and Linton Clarke Freeman in 1977. Betweenness sums up the relative number of shortest paths for each pair of nodes. It can be regarded as the extent to which a node controls the communication between nodes. In this research, it is denoted as a structural control. A detailed explanation and equation will be presented in Section 2.5: Network Theories.

Flexibility consists of the attributes of production technology which accommodate greater output variation (Stigler, 1939). Flexibility is based on a firm's cost curves. Later, flexibility was redefined as a firm's response to uncertainty, especially to market imperfections (Hart, 1942; 1965). There are many definitions of flexibility. In this research, the definition of flexibility is the ability to deal with all forms of turbulence in the firm's business environment (Carlsson, 1989).

Flexibility in multinational corporations is about the flexibility to transfer resources, e.g. production capacity between locations in different countries as a reaction to environmental changes (Kogut, 1985). Three aspects of flexibility involved in the business are management (strategic), engineering (technological), and manufacturing (processes) (Carlsson, 1989). The management aspect is the focus of this research. This research also focuses on strategic flexibility, as classified by Carlsson.

2.2 Theoretical Framework

Figure 2.1 illustrates the theories which framed this research, and the methods employed to achieve the research's objectives. The ownership structure of a company plays a significant role in determining the firms' behaviour (Chandler, 1962). Many types of research have acknowledged that the structure of a company determines their corporate strategies (Demsetz, 1983; La Porta et al., 1999). However, the tools employed to analyse the ownership structure in previous research were limited.

The ownership and control structure in GLCs and FOBs is complex and unclear. There are cross-interactions between the companies in the corporations. It is believed that concentration of control is in the hands of the owner. The decision-making behaviour reflects the owner. However, to what extent is this notion valid? This research is designed to answer this question objectively. Many studies have dealt with the GLCs and FOBs (Almeida & Wolfenzon, 2006; Burkart, Panunzi, & Shleifer, 2003; Dyer, 1988; Gomez & Saravanamuttu, 2013; Shleifer, 1998; Shleifer & Vishny, 1986; Villalonga & Amit, 2006). However, none of these studies employed network analysis as their mode of analysis.

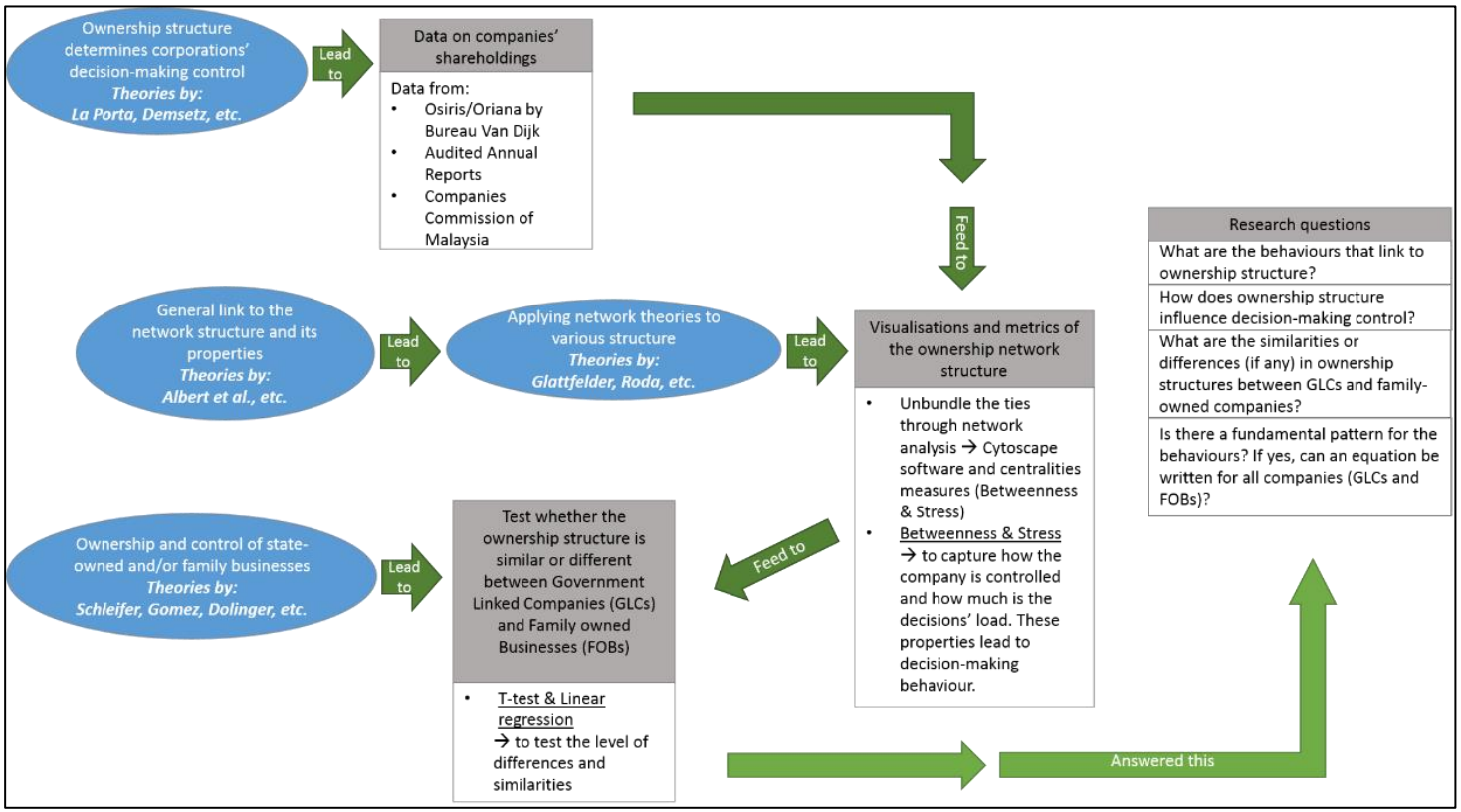

Figure 2.1: Theoretical framework of the research

Due to this scientific tool's advancement, it is now possible to analyse and understand a complex network. A complex network is analysed using a tool called network analysis. In this research, the network analysis consists of two main components: network topology and network metrics. Network topology is the visualisation of the nodes and links arrangement in the network. Network metrics are the parameters that describe the network in various perspectives. The focus will be on two network centralities metrics, betweenness and stress, which capture how the company is controlled and how much is the decisions load. These properties shape the results and the discussion of a company's decision-making behaviour.

The data on the shareholding's structure was fed into the network analysis tool. This method was initially applied by Glattfelder (2010), then followed by Roda, Kamaruddin, & Tobias (2015). This research replicates the method in Roda et al. (2015), and expands the scope of analysis to the GLCs and FOBs, as well as the statistical modelling. Statistical modelling is to test the level of similarities or differences within and between the two types of ownership identity.

The theories employed are to support and frame this research to answer the research questions. The research questions were developed according to the logical framework presented in Chapter one.

2.3 Ownership Structure and the Decision-Making Behaviour

> "*The central economic and policy problem is to allocate decision and control rights to parties who have the incentive and information to use resources efficiently to create wealth and ensuring the controlling parties are accountable to all other participants.*" – OECD

The above quote indicates that the decision-making behaviour of a corporation is critical in understanding how they allocate their resources efficiently. This research analyses the behaviour based on the interactions among the companies in the shareholdings network.

Firstly, this section reviews previous work related to the scope of this research. Secondly, it highlights the gap between past studies and this research. The reviews are divided into three sub-sections: separation of ownership and control, interlocking ownership and control, and assessment of the corporate behaviour.
Separation of ownership and control

Miles et al. (1978) presented a theoretical framework to analyse organisations as an integrated and dynamic whole. They studied the interrelationships between strategy, structure and process. There are four strategic types of the organisation when solving problems, where each type has its unique strategy,

structure and process. They believed their framework benefited from organisational adaptations. This theory is significant in this research.

There are two opposing arguments on the separation of ownership and control. The first argument states that the separation reflected in the decision-making process is one where the owner may have no control over the decisions as the corporations grow larger, and control lies in the hands of the firm's managers. On the other hand, the separation did not exist and the ultimate owner still has significant control over the decision-making of the firm. This research attempts to provide perspectives where both arguments are valid based on the method that is employed.

Many large corporations emerged and possessed resources and economic power which was previously dominated by the government (Lee, 1990). Lee (1990) relates this to Berle and Means's seminal study in 1932 which states that a large number of owners could decentralise managerial control, as the ownership disperses. The separation of ownership and control significantly affects the decision-making structure in the firm. The transfer of information would not be efficient as the firm grows larger. Organisational hierarchy resulted as in loss of control at the top of the unitary form corporation (U-form) and centralised organisation. The multidivisional corporation (M-form) managed to solve the control loss by dividing their activities amongst a number of sectors (Chandler, 1982). According to Jensen and Meckling (1992), ownership structure is significant in determining a firm's objectives, shareholders wealth and the discipline of the manager.

The survival of organisations is characterised by separation of 'ownership' and 'control' (Fama & Jensen, 1983). This separation is reflected in the decision-making process for the survival of organisations. Decision agents are mostly in control without having ownership in the organisation. This is common among large corporations worldwide. There are four steps in the decision process: (i) initiation, (ii) ratification, (iii) implementation, and (iv) monitoring. Initiation and implementation are categorised under decision management, while ratification and monitoring are under decision control. Decision management and decision control each belong to a different agent.

The managerial structure of banking corporations is reflected in the division of decision-making power in the banking sector in Canada (Martz & Semple, 1985). They suggested that the internal corporate structure influences the extent of interdependence between divisional and corporate headquarters and divisions.

La Porta et al. (1999) tested their hypothesis contradicting the idea of Berle and Means (1932) on separation of ownership and control among large corporations. They identified the ultimate controlling shareholders of various large corporations in 27 wealthy economies and posed four critical questions. First, what is the current status of widely-held firms in different countries? Second, who are the

significant owners of these firms? Third, how do the owners secure their control over the firms? Fourth, what are the differences in the ownership patterns between countries?

They identified the ultimate controlling shareholders based on ownership stakes and displayed the level of complexity of the ownership structure. The controlling shareholders have control over firms through pyramidal structures and participation in the firms' management (La Porta et al., 1999). They found that the argument presented by Berle and Means (1932) on the separation of ownership and control of widely-held shareholdings is common mainly for large firms in the United States. This is not the case in most other countries, where the companies have an ultimate owner. Based on their findings, the most common ultimate owners of corporations are the state as well as families or their descendants.

Interlocking ownership and control

This sub-section reviews and explains how the ownership and control structure of a company becomes complex. It is not unique to a specific region, or specific business activity, but is diverse in nature. These diverse interactions contributed to the complexity of the ownership and control structure of a company. This research was able to visualise the complexity in the results presented in Chapters 4 and 5.

In Malaysia, Lim Mah Hui (1981) highlights two types of shareholders: (i) personal shareholders (ordinary individual shareholders, director shareholders) and (ii) non-personal shareholders/institutions (corporations, nominees, trustees, investment companies, banks, public entrepreneur and others). The types of shareholders may determine the strategies of the company. Different shareholders may have goals other than maximising returns on their investment. The shareholding differences shape the complexity of the structure.

Corporations are interconnected through: (i) interlocking stock ownership (by the types of shareholders, pyramiding), (ii) interlocking directorships, (iii) sharing of common management and secretarial agencies, (iv) common creditors, and (v) common purchasers/buyers. Interlocking directorates refer to situations in which one or more companies have one or more members of their respective boards in common. Directorship is a means to enhance ownership interest and control of the big owners who are also directors. It could be interlocking internally (interlocks between company within the same sector), and externally (interlocks between company from different sectors). At the time of Lim's publication of his book, the computer tools available were limited and did not visualise the complexity of the structure. Nevertheless, he still managed to analyse the interlocking qualitatively and extensively.

The economic significance of interlocking are ownership interest, strengthening control, and other economic benefits. Ownership interest is achieved if the company shares a common principal owner. This ownership link will usually be accompanied by one or more director links (financial institutions maintaining control over the companies). Strengthening control over the economic environment (for environment control of tin, rubber, cement sectors) is crucial to squeeze out the competition, for price fixing, and to determine supply in the market. It is needed to coordinate strategies and actions, a process facilitated by sharing common directors. Government participation in economic development will generate extra economic benefits for the corporation. Hence it is important to maintain good state–corporation relations.

Sonquist and Koenig (1975) presented the reasons of interlocking ties: (i) management control theory – to facilitate business and information sharing. In some industries, companies are subjected to more state regulations and concessions (tax exempt, tariff protection). (ii) Environmental control theory – to strengthen companies' control over the market. (iii) Financial control theory – identified financial institutions are the core of the interlocking system. (iv) Class hegemony theory – represents a social network that binds members of upper class together.

Sieh (1982) defined control by categories: (i) owner control if a person/family/group holds 80% or more of the company's vote, (ii) majority control if a person/family/group owns between 50-80%, (iii) substantial minority if they hold 30%–50%, (iv) small minority if they hold above 5% but less than 30%, (v) management control if they hold at least 5%, and (vi) undetermined, if large vote holdings are nominees.

There are three types of control: first, external corporate control, dealing with regulations due to forces outside the company in the environment (e.g. government rules and law). Second, internal corporate control, which has ultimate and legally enforceable power to select or dictate the management of a company. It is done through the proper appointment of the board of directors (BOD), who create company policies and select top executives to implement decisions. It exercised by those who command the largest voting strength within the company, who may or may not be the shareholders. Internal corporate control could be carried out by shareholders who do not manage, managers who own shares, and managers who do not own shares. Lastly, internal business control, which has power over the actual deployment of assets and resources. This research focuses on the second control, internal corporate control.

Sieh (1982) highlighted five types of ownership of shares: public companies, financial institutions, individuals – widely dispersed investors, financial intermediaries (small saving individuals), and government. The distribution of shares can also be classified according to the type of institution (individual, financialinstitutions, government, cooperative and private companies). Financial institutions here refer to investment companies, insurance, trustees and banks.

She regards share ownership data as an important piece to complete the puzzle of total wealth ownership in the economy.

Lim and Sieh's research work were done more than 30 years ago. However, the issue of their research is still relevant today. This research will fill the gap by providing new perspectives on the ownership structure of companies in Malaysia, by using the network analysis tool. This tool will provide new insights that may not have been discovered before. As companies evolved, so does the research done and the tools used to analyse them.

Assessment of corporate behaviour/corporate governance

Chapelle and Szafarz (2005) aimed to improve the methodologies in calculating the magnitude of separation between integrated ownership and integrated control among shareholders. They identified and defined the synthetic control ratios. Their study applied the calculations to Albert Frere's empire, who is one of the influential business figures in Europe. They found that real power lies in the capitalistic system, designed for the complex structures found in Continental Europe and Asia. They suggested a graph theory to complement and enhance their method. This is one of the reasons for employing network analysis in this research.

Obata (2003) highlighted some of the key attributes of a pyramid ownership structure (POS) as: (i) the ultimate owner has a larger cash flow ownership in the top firms rather than the bottom firms, 38.7 percent of 2980 companies are controlled through POS. Half of the 38.7 percent are controlled by families; (ii) the ultimate controlling family selectively decides to rescue a distressed firm on the top of the pyramid because it is perceived as the core firm; (iii) the bottom firms in the pyramid group get looted to prop up the top firms in the same group. When any of the top firms receive a negative shock, they channelled to the lower firms in the hierarchy; and (iv) group affiliation has a positive effect on the valuation of firms when a firm is in financial distress. However, this is only true if there is low quality of investor protection, a situation that prevails in many developing countries. This adds to the understanding of the features in the pyramid structure.

Lee (1990) traced the development of theoretical work on corporate behaviour and the issues that need to be confronted. She mentioned that Williamson (1975) highlighted the problem of control in a firm. Williamson's notion was that an expanding firm would have difficulties in transferring information between various departments effectively because of its operational complexities. This would lead the firm to increase the hierarchy, which would reduce effective control by the management. She concluded that theories of corporate behaviour are more diverse, more realistic, and more complex but less complete than in the 1930s.

The issues concerning ownership structure and corporate governance, ownership structure and owner influence, and owner influence and firm attributes have been integrated into the vast literature, but no specific method is mentioned (Connelly, Hoskisson, Tihanyi & Certo, 2010). This research is designed to assess three aspects: owner influence, ownership structure and firm attributes. Network analysis is able to assess these issues, also used here to distinguish between corporations' decision-making behaviour.

From a financial point of view, shareholders who do not have enough control and influence over the management of the company can lead to inefficient governance. For example, splitting the equity into smaller units and allowing for larger amount of capital leads to imbalance control in the company. However, it prevents the expansion of control in the pool of people who can manage but are not wealthy (professional managers). If equity interest is broken into smaller portions and held by many investors, the capital providers can diversify the risks (Blair, 1995). Actual governance and control of corporations occur through a myriad of customs, cultural norms, and institutional arrangements that are not written, but may be heavily influenced by it.

2.4 Ownership and Control of GLCS and FOBS

This section reviews previous studies related to large corporations in the global and Malaysian contexts. Large corporations are vulnerable to governance issues because, usually, large corporations are public enterprises where part of their earnings come from the public.

The discussion is followed by a section on the studies of ownership and control in GLCs and FOBs. It is to demonstrate their differences and/or similarities in terms of ownership and control. Based on these reviews, it is clear that there has been no research comparing the GLCs and FOBs. This research takes the opportunity to undertake this pioneering task to compare ownership and control related to decision-making behaviour of GLCs and FOBs.

Large corporations and governance

There were five developments of intense focus about corporate governance issues among large corporations (Blair, 1995). Firstly, the perception in the mid-1980s was that US companies were falling behind their Japanese and German counterparts due to the rate at which they were investing in new plants and equipment. Secondly, came the wave of hostile takeovers, leveraged buyouts, and corporate restructuring in the 1980s. Thirdly, there was a huge increase in standard compensation packages for corporate executives. Ballooning pay packages are evidence that executives are out of control. Fourth, there was a continued process of restructurings, boardroom shake-ups, and 'downsizing'. Finally, the dramatic breakdown of the socialist economies of Eastern Europe and the former Soviet Union. Both the governance systems to manage and

control the newly-privatised industries as well as the legal and institutional infrastructure needed to support these governance systems and to protect and encourage further investment had to be created from scratch.

There are three different clusters of views about corporate governance. The finance model – where a company is owned by shareholders and should, therefore, be managed in the interest of shareholders. However, as share ownership disperses, control over managers became challenging as managers often dominated resources. Secondly, managers are too attentive to the interest of shareholders. Financial markets are impatient and short-sighted, and prefer short run gains (shareholders). "Market myopia" companies underperform because they are too responsive to short-term pressure. Finally, corporate policies that generate the most wealth for shareholders may not be policies that generate the greatest total social wealth. This research does not delve into corporate governance issues specifically, but the findings would have an impact on corporate governance practices, especially in decision-making control.

Separation of ownership and control raises four types of challenges involving governance. Firstly, management must be flexible in making strategic decisions and taking advantage of investment opportunities. In a company where ownership and control are not separated, it is easier to be flexible. Secondly, a small, close-tied group of shareholders with a large amount of shares might be effective in monitoring management, but they need to be restrained to prevent them from having an unfair advantage over other shareholders. Thirdly, time and resources are a major commitment to act as effective monitors. Many investors prefer liquidity and diversity which are not consistent with time and resources. Lastly, releasing certain types of information to the public can weaken a company's competitive position. In this research, we highlighted the challenges of flexibility among the corporations related to their decision-making behaviour.

Politically-driven business is a strategy pursued by most latecomers and a universally type of statism is applied to catch up with other corporations in the global economy. Political business can be a strategy to channel available funds to strategic industries in a late-starting and scarce capital country (Evans, 1999). A private entrepreneur has to respond to market events to maximise profit. Politically-driven businesses benefit from market profits, reward structures within party and state, and social and commercial demands from their constituencies. Government and big business ties are a symbiotic relationship (Hunt & Sherman, 1972). Strategic trade policy/free trade leads to national prosperity and safeguards national interest by shielding the economy against outside influence through aggressive and discriminatory policies favouring domestic capital by putting 'politics' in command.

There are four distinct patterns of capitalist development (Scott, 1997): (i) the Anglo-American pattern where financial institutions have become the principal shareholders. The intercorporate network in this pattern is central, and control is through a constellation of interest; (ii) The German pattern: mobilisation of capital

is through a banking mechanism that makes long-term capital available; (iii) The Japanese pattern: clustering of enterprises into tightly integrated sets within which capital is circulated from one another; and (iv) the Latin pattern: shareholdings of families, banks and investment companies. They are intersected by the mutually supporting way and form control patterns that allow a continuum of family influence within a more depersonalised investment funding system. Directly, the corporations involved in this research have the Japanese pattern and probably partly Latin American pattern. Indirectly, the Anglo-American pattern is similar to GLICs ownership in GLCs, where the GLICs are the financial institutions of the government.

The Malaysian context

Due to limitation in the scope of this research, reviews of literature on ownership and control of GLCs and FOBs in Malaysia is weak. This is because most of the literature were focussed on the political business in a wide spectrum of economic sectors, not specific to the agriculture and plantations sector. However, there are some previous research that is highly related to what this research is focusing on.

In the 1960s, Malaya's market economy was ubiquitous (Puthucheary, 1960). His book highlighted post-colonial continuation of business activities characterised by a very small number of producers, and output was small. Medium-scale activities were most prominent in commerce, manufacturing and mining and they were dominated by the Chinese.

Puthucheary (1960) highlighted that the focal point of control was the agency houses. The agency houses were the British trading and investment companies. The activities within the agency houses spread through the economy and they were active throughout the country. They were most evident in the agriculture sector as this was the primary sector in the country at that time. They controlled approximately 75% of two million acres of plantations. Their form of control was strengthened by an intricate interlocking of directorships of various rubber companies.

The other sector that the agency houses dominated was commerce. They owned and controlled the production of exports. They dominated the country's export trade (agriculture and smallholder produce). They controlled 25% of Malaya's export which was a result of their ownership of companies involved in shipping and insurance.

The basic unit of control was the managing agency. Many large secretarial firms set up holding companies which specialised in holding shares of rubber companies. Puthucheary (1960) presented the interlinking of the agencies through the different secretarial groups. This interlocking structure is similar to what is present today among the GLCs and GLICs. Three control mechanisms

stated in the book are: (i) the holding of shares in companies by agency houses and secretarial firms; (ii) the shares held by rubber companies, controlled by agency houses and secretarial firms in other rubber companies (inter-company holdings); and (iii) the shareholdings of investment trusts or holding companies.

Puthucheary (1960) highlighted the ownership concentration and control structure of the Malayan economy. The agency houses played the most significant role in the economy as they owned and controlled most of the economic activities and secretarial firms. There was no information of the volume in ringgit or dollars held by the agency house; the book only mentioned this in percentage terms. The book provided evidence of interlocking directorships among agency secretarial firms. Puthucheary (1960) argued that there was a lack of understanding of the extent of control that agency houses, mining agencies and import agencies had over the economy of the country.

In another study, by Sieh (1982), there are three mechanisms of control – inter-company devices, constitutional devices, and interpersonal device. Inter-company devices include multilayered subsidiaries and sub-subsidiaries (pyramiding). It is divided mainly into the majority (>50%) and minority (<50%) shares ownership. It includes pyramiding, cross-holdings, and circular-holding. As for constitutional devices, the capital gearing will be high when the ratio of capital-to-share is high. It is also regarded as special class power. Lastly, the inter-personal device involved the voting agreement, a voting trust which is equivalent to trustees, irrevocable proxy and nominees' device. This is in the form of corporate, nominee companies, bank nominees, insurance companies, trust companies, personal trustees and public trustees (Sieh, 1982).

2.4.1 Government-Linked-Companies (GLCs)

The first part of this sub-section reviews various ownership and control aspects found in the GLCs in Malaysia. Puthucheary, as noted, did a pioneering study on this topic. This was followed by studies by Lim (1981), Sieh (1982), and Gomez (1990) who discussed in detail the landscape of ownership and control of corporations in Malaysia. The reviews on related studies done in the other countries, where GLCs are referred to as SOEs, is presented later in this sub-section. Based on these reviews, there is no study which specifically discussed GLCs or SOEs in the agribusiness and plantations sector.

In Malaysia, the development of large enterprises was also attributed to privatisation, industrialisation and the promotion of Malay-owned conglomerates. The New Economic Policy (NEP) was introduced in 1970 to employ public enterprises, later called government-linked companies (GLCs), to venture into various sectors of the economy on behalf of the Malay *Bumiputera* (or "sons of the soil"). The primary focus of the NEP was to ensure more equitable distribution of corporate equity between the ethnic groups of this multiracial society (Gomez & Saravanamuttu, 2013).

In his pioneering study of ownership and control of major firms in pre-Independence Malaya, Puthucheary (1960) showed the overwhelming dominance that foreign, mainly British, enterprises had over the Malayan economy in the early 1950s. From 1957, when Independence was attained, until the watershed events of May 1969, Lim (1981) noted that ownership and control of the corporate sector, particularly of the largest publicly-listed firms, remained in the hands of foreign enterprises. Chinese capital had a ubiquitous presence in the economy in the pre- and post-Independence periods, but in terms of ownership and control of prominent firms operating in the national economy, their strength paled in comparison to foreign capital.

Lim's (1981) analysis of the top 100 quoted firms in the 1970s made some other important points. Firstly, there was significant interlocking stock ownership among some prominent corporate groupings, indicating the concentration of control over the economy; this control was primarily in the hands of a few large firms. Lim's study revealed that of the 100,000 shareholders in Malaysia's 62 large corporations, 797 of them – or a mere 0.8% – owned 69% of the RM1.4 billion worth of equity. Within this group of 797 shareholders, the top one percent owned 29% of this RM1.4 billion equity, while the top 50% owned 97% and the bottom 20% only 0.4%.

Secondly, Lim (1981) noted extensive interlocking directorships, identifying three types of directorates: owner-directors, executive-professional directors and functional directors. Owner directors were equity owners who also served as directors. Executive-professional directors were high-ranking employees who did not own a substantial stake in the firm. Functional directors were those usually appointed to perform "extra-economic functions"; these directors were usually former senior bureaucrats who could perform "advisory and brokerage functions". Lim suggested that directorate interlocks were used "to strengthen control over corporations in which one has ownership interests." Thirdly, although the government had attempted to develop domestic Bumiputera capital, more than a decade after Independence, no individual of the Malay ethnicity had emerged with a significant presence in the corporate sector.

Gomez (2002) raised questions about the sustainability of big business and drawing attention to the issues of state intervention and business strategies. He believed that business strategies need some state intervention, but if it's heavily conditioned by state policies, the business longevity and sustainability of the firm diminishes.

Gomez et al. (2017) noted that government-linked investment companies (GLICs) have joint shareholding of a range of public-listed firms. However, in numerous cases, one of these GLICs has majority ownership of a quoted GLC. Block shareholding, including through obscure private firms, of listed enterprises is common among the GLICs. Block shareholdings help shield the collective majority ownership that GLICs have over major quoted companies. In a situation where a state has strong political influence, and through GLICs have ownership

in the listed companies, it is unlikely that private investors or even foreign enterprises will attempt to institute a takeover of these firms. The research was carried out systematically to assess the various mechanisms of control by the GLICs in the GLCs among the top 100 public listed companies. However, they did not demonstrate control in the decision-making explicitly through pyramiding and cross-shareholdings within and between the companies structures network like this research did. Focusing only on GLICs and GLCs in various economic sectors, no comparison were made with other companies with other ownership types. However, they included the illustration and computation of the power influence of the GLICs using Bonancich's algorithm, where this research did not cover.

Some quoted GLCs come under a holding company or a GLIC. These quoted GLCs, in turn, function as business groups, involving the use of a holding company – and, in some cases, cross-holdings and pyramiding – reflecting that this is an extremely important corporate control mechanism. Since GLICs function primarily as holding companies at the apex of a large number of quoted and unlisted firms, the concepts of business groups and pyramiding require thoughtful consideration.

Leff (1978: 663) defines a business group as "a group of companies that does business in different markets under a common administrative or financial control". Granovetter (1995), in a similar fashion, sees a business group as a corpus of firms, mutually bonded by varying degrees of legal and social connection, which transact in several markets under the control of a core firm.

The organisational structure has a bearing on the firm in receiving the rent distribution. It involves an analysis of power centralisation. A high level of economic growth recorded by South Korea, Taiwan, Singapore, Malaysia and Indonesia had been attributed to the presence of a strong state. It enabled owners to achieve much autonomy from the state. It then contributed to a desire by capitalists to seek some influence over policy-making.

State control over the financial sector had been important in determining the growth in the particular economic sector and certain corporate enterprises. For example, the use of tax breaks, access to bank loans and providing lucrative rents are some examples of the extent of state control. Control of a public-listed company permitted the rise of complex cross-holdings involving other quoted companies and private firms, thus facilitating rapid growth.

A framework by Murtha and Lenway (1994) highlighted the government's organisational capabilities, and how its political structures affected MNCs strategies and structures and showed why and how government policies affected managers' choices. They highlighted that government ownership made firms more susceptible to the demands by citizens, such as social and political goals, ahead of efficiency and profit. MNCs prefer flexible strategies that do not depend

on government or political interests. However, in developing economies, the government leverages the inducement on the sector in which MNCs have the advantage. Target specificity, policy credibility, and institutional arrangements are the basis that drives state industrial strategy capabilities which would have an impact on MNCs. The study suggested that government-owned MNCs may have similar flexibility and be decentralised if the contracts are targeted strategically, the policies are consistent with MNCs strategies and driving the strategies within each other's unique capabilities. Industrial strategies cover government plan to allocate resources with the intent to meet long-term national economic objectives. There are also opinions on why government should not command business to perform, but to induce (Lindblom, 1977).

Questions about how we can understand and explain the power and the significance of big businesses have been raised in many parts of the world. It is challenging to explain because the identities of the real people who run the businesses and determine the strategies are elusive (Scott, 1997). The link between ownership and control has been broken. The owners who hold shares may become separated from any effective control of the business. Direct owner-control gets weaker as the number of shareholders get bigger. This is due to the lower concentration of shares per shareholder.

Zhao (2010) examined the impact of ownership type and ownership concentration of Chinese business groups on diversification strategies. The government-owned companies are more diversified compared to private ownership (Zhao, 2010). The author mentioned that his findings support the political/economic views on diversifications in emerging economies. Additionally, companies with higher ownership concentration are less diversified, due to the large shareholder groups acting as a control mechanism and ensuring that management acts to suit their interest.

Li and Wu (2010) examined the relationship between board governance, ownership structure and company's growth of small and medium-sized listed companies in China. Statistical analysis results showed that corporate governance indicators of different ownership structures have different effects on the company's growth. For absolute control of the company, the study suggested that more institutional investors and market players participate in the company's governance. They suggested that state-owned shares should be reduced and the supervisory role of government departments should be strengthened.

2.4.2 Family-owned Businesses

This sub-section reviews various ownership and control aspects found in the family-owned businesses. Unlike GLCs, the discussion and studies on FOBs' ownership and control are limited. The following reviews indicate a gap is prevalent, i.e. no study has analysed the agribusiness and plantations FOBs' corporate structures.

The family-owned company is a dominant type of company (Daily & Dollinger, 1992). In the United States, about 80 percent of businesses are family-owned (Kirchoff & Kirchoff, 1987; Sexton & van Auken, 1982). Family-owned firms are relatively smaller than government-owned firms, as proven in the analysis by Daily and Dollinger (1992). The family-run firms are dominated by a strong individual character, who is reluctant to allow the firm to exceed his or her personal management competencies. Besides that, it is believed that the internal control systems in family-owned companies are less formal in which the owner could have personal control over shared control of the decisions.

In publicly-traded companies in East Asia, it is evident that the ownership is between the government and the family (Claessens, Djankov, & Lang, 1999). The control chain of decision-making in these two types of ownership is complex, due to its structural complexity. Scott (1997) argued that business activities are progressively shaped by those who have large shareholdings and power to influence corporate affairs. Even though some individuals or families could have the same capability, in most cases the principal owner is another company or a financial institution. Financial institutions such as banks, pension funds, and investment companies, who have been important players in the capital market, have become dominant in share ownership. Furthermore, they created extensive inter-corporate capital relations in the advanced capitalist economies.

The owners of Malaysia's leading public-listed enterprises, predominantly families, have managed to build corporate empires through effective use of holding companies that facilitate interlocking stock ownership of corporate equity. In this system, the holding company need not own a majority of the shares of a public-listed company (PLC) to control the PLC's decision-making. These quoted companies, in turn, tend to own and control a large number of unlisted enterprises and usually operate as business groups with equity interests in a range of sectors (Gomez & Jomo, 1997). Gomez (2002), in his book, recommended tracing the inter-relations between politics and business to determine their influence on enterprise development, corruption and consolidation of democracy in East Asia.

Morck and Yeung (2004) discussed how control pyramids are used to exercise power in family firms. They believed that control through pyramids makes firms vulnerable to poor governance. Agency problems, family values, long-term planning and political connections are among the advantages of family firms highlighted by Morck and Yeung. On the other hand, they also discussed key issues related to pervasive family control and their implications.

The limited literature on family-owned studies are due to several factors. Firstly, because of the wide acceptance of Berle and Means's (1932) ideas in which control of businesses is in the hands of professional managers, not the family. Secondly, it may be due to difficulties in the multi-disciplinary study which focuses on family and business systems, and finally, due to a strong belief that

work and family systems exist exclusively here and is self-contained (Lansberg, Perrow, & Rogolsky, 1988).

Daily and Dollinger (1992) examined the extent of differences in structure, process and performance based on ownership and control in small private firms. They tested the hypothesis that owner-controlled firms will outperform management-controlled firms. It was found that family-owned and managed companies exhibit performance advantage because of the unification of ownership and control. The data was collected through a field survey which could lead to perception-based answers which is a disadvantage as it is not representative of reality.

Mansor, Che-Ahmad, Ahmad-Zaluki, and Osman (2013) compared family-owned companies to non-family-owned companies. The comparison was to provide evidence on corporate governance mechanisms of the two groups of companies. Based on the statistical analysis, it is evident that both groups were using different corporate governance mechanisms to control earning management activities.

Alwshah (2009) discussed corporate governance and agency conflicts of companies in Jordan, where most of the companies are family-owned. The firm's ownership is concentrated with strong large shareholders among families, local financial institutions and foreign shareholders. There was no comparison made between family and non-family-owned firms in the study.

Ibrahim and Samad (2011) examined the relationship of corporate governance mechanisms and performance between publicly-listed family-owned and non-family-owned firms. They used the market measure, Tobin's q, and accounting measures such as return-on-assets, and return-on-equity as their performance measurement. Parameters of corporate governance mechanisms were gathered from companies' annual reports such as board size, independent directors and duality. The study concluded that family ownership is governed differently from non-family-owned firms.

Family firms are the most common form of business organisation in the world (Ibrahim & Samad, 2011). It is acknowledged by many researchers all over the world (Anderson & Reeb, 2003; Favero, Giglio, Honorati, & Panunzi, 2006; Gorriz & Fumas, 1996; Gursoy & Aydogan, 2002; Mishra, Randoy, & Jenssen, 2001; Sraer & Thesmar, 2006; Yeh, Lee & Woidtke, 2001). In these studies, it was found that family firms have superior performance compared to non-family firms.

In Malaysia, family-owned companies constitute over 43 percent of the main board companies of the Bursa Malaysia (formerly known as the Kuala Lumpur

Stock Exchange (KLSE)) from 1999 to 2005. However, studies examining the shareholdings structure of family-owned firms are very limited.

Abdul Rahman (2006) highlighted that many listed firms in Malaysia are owned or controlled by a family and that these companies appear to be inherited by their descendants. Since independence, most Malaysian companies have been controlled by foreigners. Small and medium scale enterprises (SMEs) in Malaysia are managed by the founder, and they have anchored funding and employment on the family (Jasani, 2002). Their business activities are concentrated on trading, manufacturing and retailing, and non-intensive capital business. There are also SMEs that are opposed to anchoring employment to the family.

Indeed, the firms were led by the founder with activities concentrated on trading, manufacturing and retailing. Jasani (2002) found that 59% of the businesses in Malaysia are still managed by the founder while 30% are run by the second generation, where the majority are the children of the founders of these SMEs. The founder's reign is highlighted, with 65% of them linked to the SME.

Chu (2009) examined the influence of founding-family ownership on SMEs performance. The question of the founding-family ownership being detrimental or beneficial for small firms was raised. It was found to be an effective organisational structure for SMEs in Taiwan, despite its negative effects. Among the negative effects discussed in this paper are the possibility of agency problems occurring, lack of clarity of roles and responsibilities among managers, institutional overlapping, the mentality of work to benefit their interests first, and succession challenges.

2.5 Network Theories

The section reviews previous network analysis research in various fields of research. This research employs network analysis because to break down the complexity of the ownership and control structure of both GLCs and family-owned companies. Pyramidal business groups and interlocking shareholdings are among the main features of this issue involving complexity. The reserach aims to uncover the complexity and to understand firm behaviour, both quantitatively and qualitatively. Past studies did not explore the shareholdings structure of a company to relate it to decision-making behaviour. This is where this research fills the gap.

The mathematical representation of networks originates from graph theory[1] (Gribkovskaia, Øyvind, & Laporte, 2007). The graph is usually used to present

[1] Leonhard Euler, the most eminent mathematician discovered graph theory through a solution to Seven Bridges of Konigsberg in 1736.

basic properties of networks in a mathematical sense. A network is a structure which consists of a set of objects, called nodes and edges or links (Figure 2.2). The links between nodes can be directed or undirected. Directed links refer to the denoted parameter, while undirected links have no denominator. Links can also be weighted, representing the qualification of the denominator. A group of nodes and links form a cluster which typically shares similarities in the main activity.

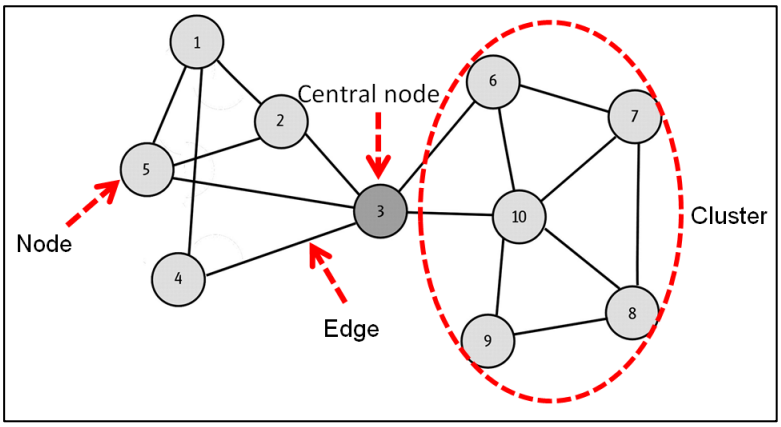

Figure 2.2: Example of a network
(Source: Roda et al., 2015)

Network analysis is an emerging tool that offers both micro and macro perspectives of any complex relationship systems. The perspectives can be measured from a single node and linked the entire network systems. This tool is suitable for analysing and conceptualising organisations, interpret social behaviour and characterise linkages or relationships/interactions. There has been vast expansion of the theory of complex network in recent years. Applying network analysis to the financial structure is new and the potential is being explored. It has been applied to a wide range of studies, e.g. in the fields of molecular biology, physics, finance and sociology. For example, in the field of biology, the network analysis is applied to molecular and genetic interaction datasets and generates powerful visualisations across the data sets.

In the social science field, it can analyse large and complex social relationships and integrate it with other tools for advanced analysis. The application of network analysis varies between disciplines. It has proven to be a powerful tool to understand large and complex interactions. Serrat (2009) stated that “social networks are nodes of individuals, groups, organisations, and related systems that tie in one or more types of interdependencies: these include shared values, visions, and ideas; social contacts; kinship; conflict; financial exchanges; trade; joint membership in organisations; and group participation in events, among numerous other aspects of human relationships.” It quantifies the hidden connections. The network perspective was already hypothesised in the literature

on corporate control (Chapelle & Szafarz (2005); Faccio & Lang (2002); Glattfelder & Battiston (2009); La Porta et al. (1999)).

Network analysis can handle a vast amount of data, within a complex system, consisting of interacting components whose collective behaviour cannot be explained by the individual units (Newman, 2001). These components may act according to rules that may change, and the outcome may not be easily understood. Examples of a complex system include human brains, societies, ecological systems, economy and financial markets (Newman, 2010).

2.5.1 Simple Network Metrics

This research is an attempt to develop a detailed network metrics that is suitable for financial and management perspectives. The objective of this research is to explore a whole range of possible metrics which could open some new perspectives to allow new possibilities or analysis to go deeper.

An embedded application in the software called “NetworkAnalyzer” which can be used to compute various network metrics. NetworkAnalyzer (the plugin program) computes a comprehensive set of topological metrics for undirected and directed networks. The plugin program computes simple and complex network metrics which we reassigned as topological parameters. The simple network metrics are: the number of nodes, edges, and the connected components, the average number of neighbours, the network diameter, radius, density, centralisation, heterogeneity, clustering coefficient, the number of shortest path, and the characteristic path length. The complex network metrics are: distributions of nodes degrees, neighbourhood connectivities, average clustering coefficients, topological coefficients, shortest path lengths, and shared neighbours of two nodes. The complete set of simple and complex parameters are referred as network statistics (Assenov, Ramirez, Schelhorn, Lengauer, & Albrecht, 2008). Table 2.1 shows the definitions of the various network metrics for a shareholdings structure that was adapted from Roda et al. (2015). He modified the definitions to a business and economics point of view.

Table 2.1: Network centrality metrics and its business and economic meaning

Network metrics	Definition
Network diameter	It is the largest tier rank of subsidiaries or shareholders, both vertically and horizontally. It measures the largest distance between two companies within the ownership structure.
Hierarchy index	It is the reciprocal of % of shortest paths. The higher it is, the more hierarchical the ownership structure is. The structure forms pyramids of tiered subsidiaries.

Number of nodes	The size of the group by a number of companies.
Average shortest path length (average ownership tier)	The average shortest distance between two companies within the ownership structure. It is the average tier rank of subsidiaries applicable to both vertically and horizontally.
Indegree (Shareholdings degree)	The number of shareholders a corporation has.
Outdegree (Subsidiaries degree)	The number of firms in which a shareholder has invested.
Betweenness centrality	The number of shortest ownership lines between two companies passing through one company, compared to all the shortest ownership lines in the network. It is an index of the actual control exerted by one company over the ownership structure.
Stress	The absolute number of shortest ownership lines passing through one company. It is an index of the decisions' load of the business group.[2]

In this research, hierarchical index is defined as the reciprocal of percentage of shortest paths in the corporation network (Roda, et al, 2015). The higher the percentage, the less hierarchical the ownership structure is. The structure forms pyramids of tiered subsidiaries.

There are three types of hierarchy in exist in the complex network structure (Mones, et al., 2012). They are; the order, the nested and the flow hierarchies. This research focused on the flow hierarchy, where the nodes are layered in different levels which have influence through the connected edges.

Krackhardt (1994) provided an elegant definition of the meaning of hierarchy, and developed measures of that. He defined a pure, "ideal typical" hierarchy as an "out-tree" graph from a directed graph which all points are connected, but one node (“the "boss") has an in-degree of one. The simplest "hierarchy" is a directed line graph A to B to C to D, and so on. More complex hierarchies may have wider, and varying "spans of control" (out-degrees of points). He raised, to be a pure out-tree, there can be no reciprocated ties. Reciprocal between two actors imply equality, and this denies pure hierarchy. However, it could still be assessed through the degree of deviation from pure hierarchy by counting the number of pairs that have reciprocated ties relative to the number of pairs where there is any tie; that is, what proportion of all tied pairs have reciprocated ties. This assessment justified our calculation which based on the percentage of the shortest path of the network (Hanneman, et al., 2005).

[2] The meaning may differ from the original document. It has been modified to suit the context of this research.

2.5.2 Centralities: Shortest Paths

Centrality metrics have an extensive history in social science as a structural characteristic of nodes in a network, and it depends on the nodes' position in the network (Bonacich, 1972; Freeman, 1978; Hubbell, 1965). Centrality is the extent to which a network is centred on a node. For example, in a star-shaped topology network, the central node has the highest centrality, and all other nodes have minimum centrality.

Centrality is an essential concept in network analysis (Borgatti & Everett, 2006). There have been many works on centrality measures in various fields of study, such as physics, biology and economics (Freeman, 2008; Schweitzer et al., 2009). It is to analyse and understand the functionality of a complex network system (Scardoni & Laudanna, 2012).

This research uses centrality metrics as proxies to quantify decision-making control. There are many types of centrality measures that have been developed as mentioned in section 2.5, but this research focuses on betweenness and stress centrality metrics. Each of the metrics is discussed in detail as follows.

Table 2.2 depicts the description of network metrics which is employed in this study. Network metrics are divided into two segments, simple metrics and advanced metrics. Simple metrics refer to the measurement of the direct physical topology structure (see Table 3.3 in Chapter 3). On the other hand, the advanced metrics, as shown in Table 2.2, are often referred to as centralities measures. There are variations of centralities measures, such as shortest paths, degree, distances to neighbourhoods, to name a few (Brandes and Erlebach, 2005). Each of the centralities employed different method of calculations.

This research was working with the shortest paths centralities. It measures the most important links and units found in the network. Shortest paths have many types of metrics, betweenness, closeness, stress, eccentricity, and others. Betweenness and stress were chosen as the centrality measure for this research because they measure important links between companies that reflect decision-making control behaviour.

Table 2.2: Shortest paths centralities employed for this research and their meanings

Network Metrics	Equation	Economic meaning	Description
Betweenness centrality	$\sum_{i \neq j \neq k} \frac{\sigma_{ik}(j)}{\sigma_{ik}}$	Structural control	The number of shortest ownership lines passing through a company, compared

			to all the shortest ownership lines. It is an index of the real control exerted by a company over the ownership structure.
Stress centrality	$\sigma_{ik}(j)$	Decisions load	An absolute number of ownership lines passing through a company. It is an index of the time taken to apply a decision to the group, or an internal transaction cost.

(Adapted from Roda et al. (2015))

Where, *i, j, k* are companies;, σ_{ik} is the largest distance between *i* and *k,* σ; $_{ik}$ is the shortest distance between *i* and *k;* while σ_{ik} (*j*) is the shortest distance between *i* and *k* and passing through company *j.*

I. Betweenness

The betweenness of a node *n* is calculated by considering couples of nodes (*v*1, *v*2) and counting the number of shortest paths linking *v*1 and *v*2 and passing through a node *n*. Then, the value is related to the total number of shortest paths linking *v*1 and *v*2. Thus, a node can be transverse by only one path linking *v*1 and *v*2, but if this path is the only connecting *v*1 and *v*2 the node *n* will have higher betweenness score. It means that the node, for certain paths, is crucial to maintaining node connections. It measures the importance of a node for two connected nodes. The 'high' and 'low' scores are more meaningful when compared to the average value of the network. The mathematical equation for betweenness is as follows:

$$g\ (j) = \sum_{i \neq j \neq k} \frac{\sigma_{ik}\ (j)}{\sigma_{ik}} \qquad 3.1$$

Where, *i, j, k* are companies; σ_{ik} is the shortest distance between *i* and *k;* while σ_{ik} (*j*) is the shortest distance between *i* and *k* and passing through company *j.*

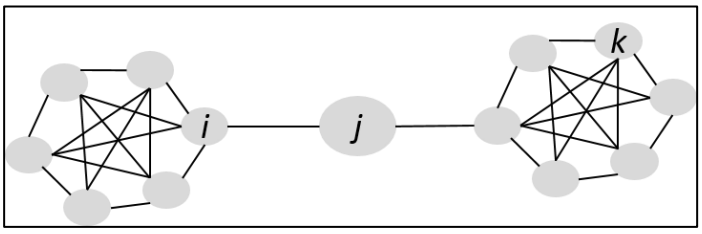

Figure 2.3: Example of betweenness centrality metric

Betweenness centrality assessed the extent to which the actor lies in the shortest paths between other actors. The important idea is that an actor is central if it lies between other actors on their shortest paths. The actor that has high betweenness must be between many actors (Badar et. al, 2013). Betweenness index has been extensively used in various social analysis involving large scale complex networks (Rajasingh et al., 2009). It includes identifying key actors in terrorist network (Krebs, 2002; Cisic et al., 2000), organizational behaviour (Bulkley & Alstyne, 2004), supply chain management (Coffman et al., 2004), and transportation network (Guimer, et al., 2005).

In co-authorship networks, betweenness shows how close the sub-network to which the author belongs and how important the author's role as a an agent (Yan & Ding, 2009). A high betweenness score would also indicate an actor's potential to act as a gatekeeper of resources between the actors they connect in a network (Marks, et al., 2013).

In economic terms, betweenness compares the number of shortest ownership lines passing through one company, to all the shortest ownership lines. It measures the importance of the ownership lines through the one company across the whole network. The higher the betweenness score, the higher the importance of the links between the nodes. The more important the nodes which have important links in the network, the higher the structural control of the companies in the corporation's shareholdings network. Betweenness is an index of the structural control exerted by one company over the ownership structure. In this study, we regard betweenness as a structural control index. The terms will be used interchangeably throughout the thesis.

II. Stress

Stress calculation is by measuring the number of shortest paths passing through a node. To calculate the stress of a node *v*, all shortest paths in a network are calculated by the number of shortest paths passing through *v*. A 'stressed' node is a node traversed by a high number of shortest paths. Notably and importantly, a high-stress value does not imply that the node v is critical to maintaining the connection between nodes whose paths are passing through it. 'High' and low' stress score for nodes are more meaningful when compared to the average stress in the network. The mathematical equation for stress is as follows:

$$\sigma_{ik}(j) \qquad 3.2$$

Where, *i, j, k* are companies; σ_{ik} (*j*) is the shortest distance between *i* and *k* and passing through company *j.*

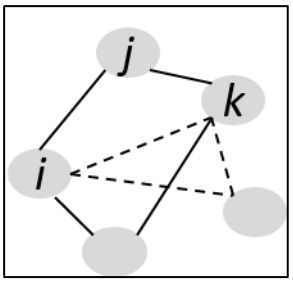

Figure 2.4: Example of stress centrality metric

Stress metric is to assess the work done by each node in a communication network. The number of shortest path linked the nodes give an estimate amount of stress for a node, assuming that communications are carried out through the shortest paths all the time (Rajasingh et al., 2009). A node has a high stress if it is pass through by a high number of shortest paths (Centiserver, 2017).

In economic terms, stress centrality shows the absolute number of shortest ownership lines passing through one company. The number of lines represents the decisions that are reflected from the ownership ties. The more the number of lines, the more decision making is involved, the more 'stressful' the company. We regard it as a decisions load index to the company. Load means when a node sends / carries a unit amount of some commodity to other node (Brandes, 2008). In this research, the commodity is the decision control via the shares owned.

2.5.3 Network Analysis Software

The research employed Cytoscape software for the network visualisations and its analysis. It was initially released in 2002 and undergone numerous development. It is an open source platform for visualising and analysing complex networks and integrating it with any type of attribute data. Cytoscape core distribution provides a basic set of features for data integration, analysis and visualisations (Shannon, et. al, 2003). It has additional features, called Apps or plugins, which available for network profiling, various layouts, and connection with other databases. Most of the Apps are free and available at Cytoscape App Store. The software was developed based on JAVA™ technology, making it compatible to Windows and Mac users.

Custom node illustrations provide a new tool for non-programmers to create specific new network visualizations that integrate large and complex datasets. Equations provide a powerful mechanism for data transformation within Cytoscape. Combining these features is useful to embed rich visualizations of data within the nodes of large networks (Smoot, et al., 2011).

2.5.4 Application of Network Theories in Similar Field of Studies

This section highlights the evolution of various concepts employed in this research – in ownership structure, decision-making behaviour, ownership and control in GLCs and FOBs, and network theories.

The economic crises that are happening in various regions suggest that it is timely to revisit and reconfigure our understanding of the economic system. Economic systems are increasingly built on inter-dependencies, implemented through transnational credit and investment networks, trade relations, or supply chains that have proven complex to predict and difficult to control (Schweitzer et al., 2009). It makes economic networks study more relevant, to facilitate and design the policies that can reduce conflicts and have a global impact.

Glattfelder and Battiston (2009) questioned whether the distribution of power in the structure is fragmented or integrated. He asked who the key economic actors are, and what \the role of financial institutions was. He discussed changes in the macro behaviour from the interactions of the system's elements at the micro level. He emphasised that complex systems have interacting/inter-connected parts. It is represented by the graph/map (nodes – agents, links – interactions). He focused his work at three levels of network analysis: topology, financial network and ownership network. The results revealed a complex ownership network pattern with a lot of cross-shareholdings (see, for example, Japan's *keiretsus* and South Korea's *chaebols*). Glattfelder classified this as a bow-tie structure and distinguished who controls the world based on its position in the bow-tie structure (top 50 list corporations).

Bonacina et al. (2014) employed graph and network theory in the study to decipher shareholdings and board of directors' networks to understand corporate governance ties. They found that the core of Italy's shareholdings networks comprised banks and financial institutions, which had the highest eigenvector centrality values. On the other hand, the core of board of directors' network is an industrial group of companies. The method was considered successful in analysing complex interrelations.

Vitali, Glattfelder, and Battiston (2011) discussed how the structure of the control network of MNCs affect global markets competition and financial stability. The results showed MNCs form a giant-bow-tie structure and a large portion of control flows to a small tightly-knit-core of financial institutions. It is like an economic 'super-entity' that raises new important issues. Complex network analysis is needed to uncover the structure and control and its implications. Economic networks are growing in attention since a decade ago. Examples of economic networks are a network of trade, products, credit, stock prices and the board of directors. These researchers focused their efforts on a study of the linkages among financial institutions which have an ambiguous outcome on the

issue of financial fragility. Combining network topology with control ranking can bring full characterisation of the decision-making control structure.

De Masi and Gallegati (2012) carried out an empirical analysis of the Italian system of banks and firms using network theory. They found that the architecture of this economic network shows unusual types of behaviour. The topology structure plays a crucial role in bankruptcy diffusion.

Howard (2009) presented visually ownership changes for the global seed industry from 1996 to 2008. It was to improve the understanding of the current structure and to characterise them accordingly. He analysed the strategies employed by the companies to achieve greater control over the seed sector. He found that the concentration of power was incompatible with renewable agriculture practices.

Connelly, Limpaphayom, and Nagarajan (2012) studied the relationship between control, ownership structure and firm value in publicly-traded companies in Thailand in 2005. Based on their results, they concluded that families control firms through pyramidal ownership structures that can allow firms to comply with preferred governance practices with significant control.
Chen (2012) investigated the effect of ownership structure on firm performance in Scandinavian countries. She used Tobin's q and Marginal q as valuation measures. The findings were that ownership concentration has a positive effect on firm profitability and growth, and a negative effect on firm valuation and risk; divergence between voting right and capital right has a positive influence on firm valuation; and owner identities do influence firm performance in profitability and growth.

Levy (2009) described and compared different methods to determine the actual control of a firm, and he applied the chosen method to a Belgian retail company. He used graph theory to define ownership structure in mathematical terms. He then described the voting game using game theory. The results showed how the ownership structure allowed the Colruyt family to keep their control in the company despite discordances inside the family.

Boutchkova and Cueto (2007) analysed corporate ownership structures of Canadian enterprises from 1998 to 2006. They found that pyramidal ownership structures in Canada are more dynamic than understood before. Their findings suggested that apex families modify the structures of their pyramid to achieve easier intra-pyramid flow of funds. They used graph theory to compute the measures describing the ownership structure.

Moebert and Tydecks (2007) identified the most powerful companies based on ownership stakes in Germany. They measured the power of companies by centrality concepts in network analysis. Their work is based on the company

network literature and corporate governance. They used the MAN-classification scheme when analysing the networks. It measures the micro network formations and concurrently provides access to a macro view of a network. Their results showed that most central German companies are banks and insurance companies. They believed that future analyses of ownership structure could be enhanced by network tools and network statistics.

Salvaj and Lluch (2011) compared ownership and control composition of the largest firms in Argentina and Chile using social network analysis. Their results focused on the networks of firms in both countries in the 1970s. They also compared the interlocking directorship and ownership pattern in banks in both countries. They extracted the important structural parameters of the networks. Chile showed more interlocks and links with big companies in their network, which provided more opportunities for control. Argentina has more broad business groups, which have fewer links. They presented the top ten most central firms in both countries, using Bonacich's (1987) centrality measure. Both countries displayed different patterns of central firms. In Chile, most of the central firms were family-owned, and as for Argentina, only four firms were local business groups. They found that Chile's business groups were more central than Argentina's. The study's limitation is its entirety in the companies' shareholdings data.

Bohlin (2012) investigated the possibility of summarising the clusters of share ownership in the Swedish stock market. She used network analysis to detect a community with similar interest, or similar pattern of ownership in the network. She found the best cluster structure in compressing the flow of information in the network. Finding significant patterns in the ownership data is possible.

New measures were proposed to describe the ownership structure of a business that goes beyond the standard measures of cash flow and voting rights. The new measures included the position of the firms and the centrality of a firm in a complex network (Almeida, Park, Subramanyam, & Wolfenzon, 2008).
However, none of these studies uses network analysis to explain decision-making behaviour of corporations based on their ownership structures. Given the cases of complex structures in firms and the economy, this study employed a neutral and versatile tool, network analysis, to understand the behaviour of companies, specifically in their decision-making.

This study is grounded on established theories and case studies. Based on the theories and far-reaching methods, the study is constructed to meet the stated objectives.

CHAPTER 3

MATERIALS AND METHOD

The detailed method of the research is presented in this chapter with explanations of the procedures used for data collection followed by the data analysis. Both research activities are grounded within the theoretical framework presented in the previous chapter.

3.1 Data Collection

Companies' shareholdings data were collected from various sources in understanding the link between ownership structure and company's strategy including decision-making behaviour. This research collected data from the major public listed companies in the agribusiness and plantations sector. There are 41 plantation companies listed on the Kuala Lumpur Stock Exchange (KLSE) for the year 2013. The study focused on the biggest eight agribusiness and plantations corporations, and they were selected based on their market capital value and their ownership type. The total number of companies involved in this study was 4,331 inclusive of subsidiaries and shareholders. The eight companies' market capital value constitute 80% of the total market capital value of the plantation sector in 2013. It justified the data adequacy and its relevance to the plantation sector.

Bureau Van Dijk, a Swedish company, provides business information through their databases such as Orbis, Oriana and Osiris for companies around the world. The research gathered ten levels of shareholdings data for all of the eight major plantation companies in Malaysia from the Osiris and Oriana business database for the year 2013. Osiris provides business information for all of the public-listed companies around the world. Oriana provides the business information for all companies in the Asia Pacific region. Information from Oriana was retrieved for 2015. This is because the database provides the company's information at the current year of access. There are insignificant differences in shareholdings information for the year 2013 and 2015.

The reason for gathering ten levels of shareholdings data is that network analysis requires an extensive data to be able to compute the network centrality metrics as precisely as possible. This research depends on the extensive data feature to map the extensiveness of the corporate structure to identify and compare the control in the business decision-making involving government-linked companies and family-owned companies. As for Osiris and Oriana, the research only counted the direct shareholdings. The indirect shares were not counted as it will lead to misinterpretation at the analysis phase. However, the companies that have indirect shareholdings in the main company were noted.

The data was also collected from the company's audited annual reports and the Companies Commission of Malaysia (CCM). Some of the data that could not be obtained from the two databases (Osiris and Oriana) were complemented by the data gathered from these sources. The soft copy of the audited annual reports for the year 2013 was obtained from the company's website. The shareholdings information were extracted and compiled. The research extracted information on corporate structure, the board of directors, and the history of the establishment.

The Companies Commission of Malaysia provides information for private limited companies established in Malaysia. Their service was requested and obtained for those enterprises that were not listed in the Osiris and Oriana database. The information gathered were the list of shareholders and subsidiaries of the private limited companies.

3.2 Research Materials

The study focused on the eight biggest plantations companies: Sime Darby Berhad, IOI Corporation Berhad, Kuala Lumpur Kepong Berhad, Boustead Holdings Berhad, Genting Plantations Berhad, Kulim Berhad, IJM Plantations Berhad and Jaya Tiasa Holdings Berhad. The companies are major players in the world compared to other players in the region as indicated in Table 3.1. The study selected the highest market capital value in the plantation sector for both GLCs and FOBs, as they are the major players in agribusiness and plantations sector.

In 2014, Malaysia's palm oil producing companies made up 57% of the total market capitalisation of top palm oil producing companies in the world. Indonesian companies contributed 14%, and Singaporean based companies had 28% of the total market capitalisation. This shows that Malaysian companies have a significant control over the world's palm oil industry.

Both market capital value and land bank area indicate the size of the companies. Out of 16 global players in the sector, nine are from Malaysia – four are GLCs and FOBs, respectively, and one is privately owned.

Table 3.1: The world's top palm oil producing companies in 2014

Company	Country	Market capitalisation (million USD)	Land bank ('000 ha)
Wilmar	Singapore	14.6	243
Sime Darby	**Malaysia**	**12.2**	**986**
IOI Corp	**Malaysia**	**7.1**	**217**
KL Kepong	**Malaysia**	**6.2**	**270**
Indofood	Indonesia	5.4	224
Golden Agri	Singapore	3.4	451
Astra Agro	Indonesia	2.4	297
Genting Plantations	**Malaysia**	**2.0**	**238**
United Plantations	Malaysia	1.4	59
Kulim	**Malaysia**	**1.2**	**91**
Boustead Holdings	**Malaysia**	**1.1**	**83**
London Sumatra	Indonesia	0.8	177
IJM Plantations	**Malaysia**	**0.7**	**80**
Sampoerna Agro	Indonesia	0.2	240
Bakrie Sumatera	Indonesia	0.05	154
Jaya Tiasa Holdings Berhad	**Malaysia**	**0.005**	**63**
	Total	**59.3**	**3,879**

Note: The companies listed are ranked by their market capital value.

3.2.1 Shareholdings structure

Table 3.2 illustrates the corporations' shareholdings information for the selected eight companies. The ownership was based on the percentage of shares owned. Shareholders were divided into three groups; family, government and private. Shares held by the family consisted of the shares owned by the relatives of the founders or directors of the holding companies. Government shareholders constitute any federal or state government-linked investment companies

(GLICs). State government-linked investment companies include the Johor Corporation, Perak State Agriculture Development Corporations, and others. Nominees companies, banks, and insurance companies are grouped under others. The ownership type was determined based on the majority shareholdings between the shareholders.

Table 3.2: Corporations' shareholdings information

Corporation name	No. of companies in the study	Percentage of shares (%) by shareholder group			Ownership type	Majority shareholder
		Family	Government	Others		
Sime Darby	750	0	59.22	24.86	GLC	Permodalan Nasional Berhad (National Equity Corporation)
Boustead	1359	3.88	65.86	11.6	GLC	Lembaga Tabung Angkatan Tentera (Armed Forces Savings Fund)
IJM Plantations	426	2.45	70.37	20.69	GLC	IJM Corporation
Kulim Berhad	105	9.84	72.48	14.64	GLC	Johor Corporation
IOI Corporation	647	45.79	10.96	29.88	Family	Vertical Capacity Sdn Bhd
KL-Kepong	505	46.86	16.68	23.2	Family	Batu Kawan Berhad
Genting Plantations	487	59.83	21.9	25.66	Family	Genting Berhad
Jaya Tiasa	89	22.77	0	53.37	Family	Tiong Toh Siong Holdings

Each of the corporation's shareholding structure is illustrated in Figure 3.1 to Figure 3.8. The figures were drawn to show the percentage of shareholdings for the major shareholders in the corporation. The figures are configured as a directed network, where the arrows targeted indicate the percentage of shares owned. It displays the decision-making links within the corporation. It also shows the various designs of ownership structures of all eight companies.

Sime Darby Berhad

As shown in Figure 3.1, Sime Darby Berhad is majority owned by Permodalan Nasional Berhad (PNB), a significant GLIC. The shares owned directly by PNB are 11% and indirectly through Amanah Saham Nasional Berhad (ASNB) are 35.15%. ASNB is a wholly-owned subsidiary of PNB. It was established in 1979 to manage unit trust funds launched under PNB. There are no cross-shareholdings seen at the shareholders level.

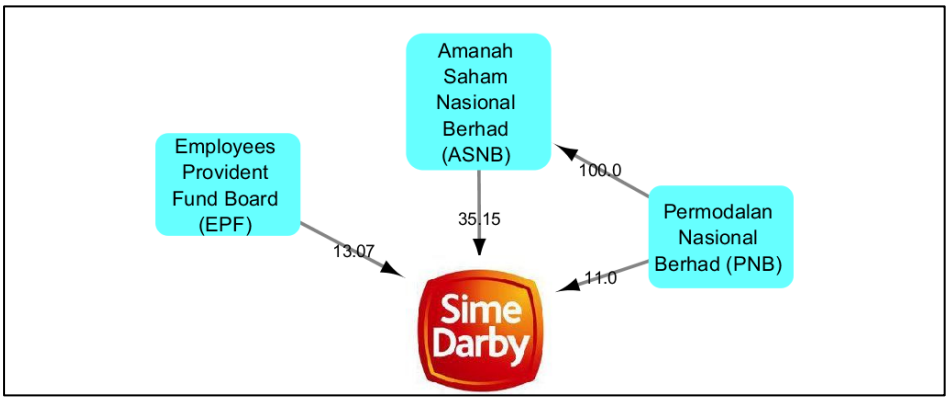

Figure 3.1: Percentage (%) of shareholdings (a directed network) by major shareholders in Sime Darby

Sime Darby Berhad is a multi-billion dollar corporation, based in Malaysia, operating in 26 countries. It is involved in five core sectors: plantation, industrial equipment, motors, property, and energy and utilities. Figure 3.3 shows their global business footprint in 2017, spreading over 18 countries. The plantation sector contributed 37% of the total revenue of the company in 2009, then it decreased to 25% in 2013. This was due to the drop in commodity price in those years. Figure 3.2 illustrates the oil palm plantation area in Malaysia, Indonesia, and Liberia for 2013.

Sime, Darby & Co was founded in 1910 by English planters: Alexander Guthrie, Daniel Harrison, Smith Harrison, Joseph Crosfield, William Sime, Henry d'Esterre and Herbert Mitford Darby. It has a long history of acquisitions and consolidations since its establishment. In 2007, Sime Darby, Guthrie and Golden Hope merged and re-entered the Kuala Lumpur Stock Exchange under the name of Sime Darby Berhad.

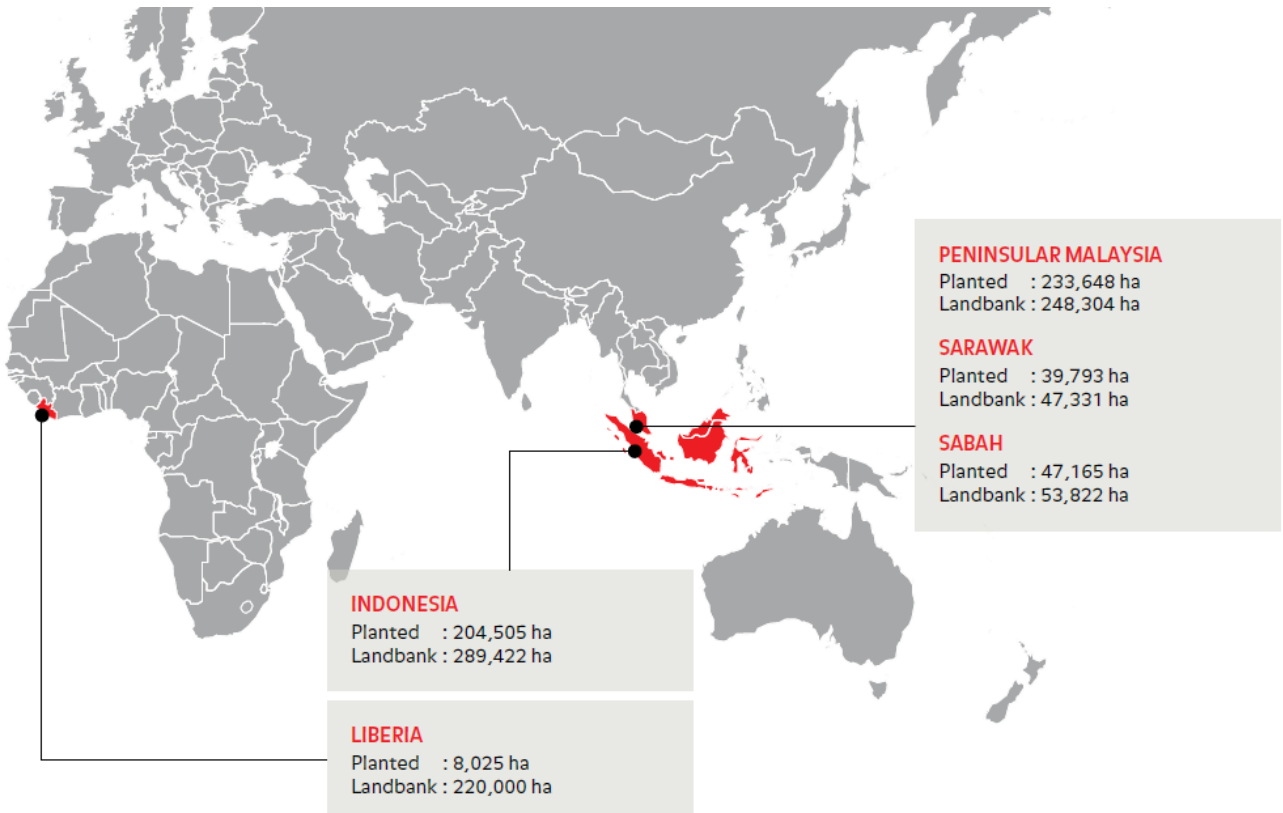

Figure 3.2: Sime Darby's Oil Palm plantation area year 2013
(Source: Sime Darby 2013 Annual Report)

Figure 3.3: Sime Darby's Footprint in 2017
(Source: Sime Darby's official website, http://www.simedarby.com/who-we-are)

Boustead Holdings Berhad

Boustead Holdings Berhad (Boustead) is owned by Lembaga Tabung Angkatan Tentera (LTAT) with a 58.69% share as shown in Figure 3.4. LTAT is a statutory body under the government. Unlike other GLCs, Boustead is the only GLC that has its director, Che Lodin as the shareholder. Che Lodin holds multiple directorships in LTAT and Affin Holdings, where Boustead is a major shareholder. No cross-shareholdings can be observed, but there are interlocking directorships.

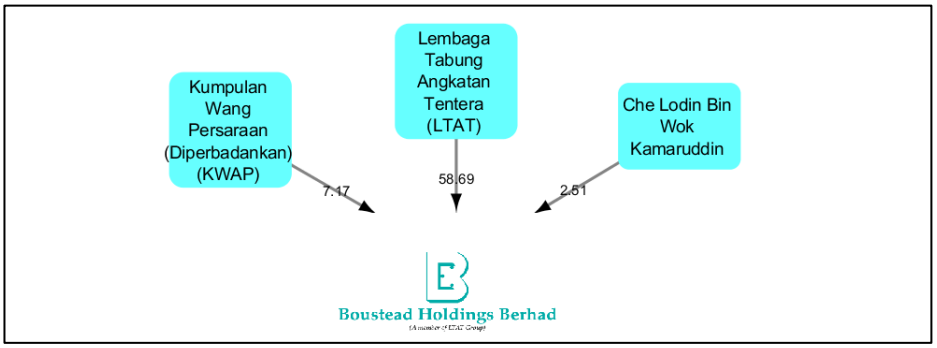

Figure 3.4: Percentage (%) of shareholdings (a directed network) by major shareholders in Boustead Holding

Its business operations are diversified, mainly in the plantation, property, finance and investment, pharmaceutical, trading and industrial, and heavy industries. The plantation sector contributed 6% of the total group's revenue in 2013. The trading and industrial segment contributed the highest revenue to the group with 47%. Figure 3.5 showed the planted and mill area for Boustead Holdings in Malaysia.

Boustead was founded by Edward Boustead in 1828 in Singapore. Boustead began trading rubber in 1911. It has undergone a series of acquisitions and consolidations. It was listed on the Stock Exchange in 1961 under the name of Boustead & Co. In 1976, the company became a wholly-owned Malaysian entity.

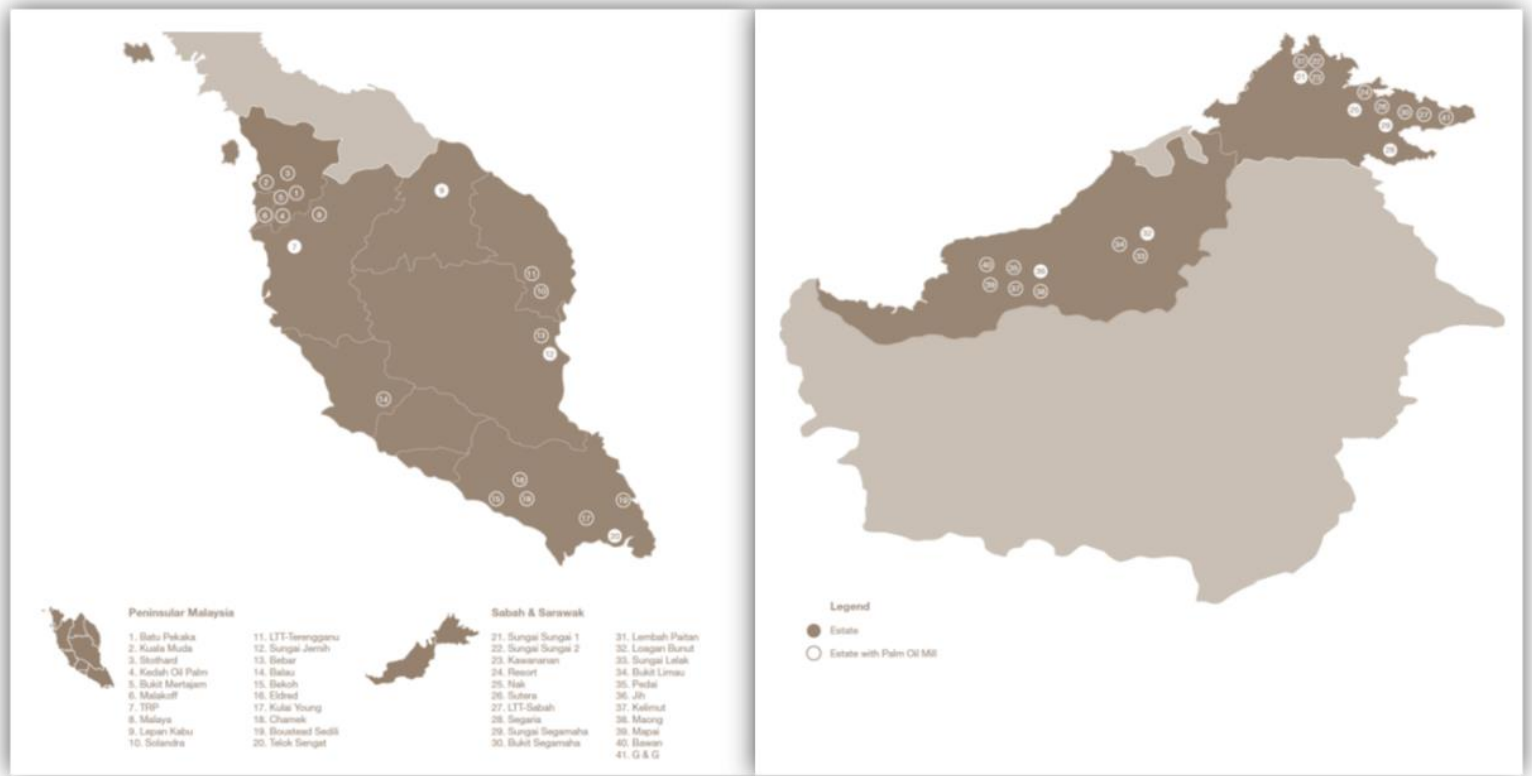

Figure 3.5: Boustead Holdings Oil Palm plantation area in Malaysia
(Source: Boustead Holdings 2013 Annual Report)

IJM Plantations

IJM Plantations Berhad is owned by IJM Corporation with a 55.11% share as shown in Figure 3.6. IJM Corporation's major shareholder is the Employee Provident Fund (EPF), a Malaysian government agency. IJM Plantations and IJM Corporation showed a business group link. Unlike Sime Darby and Boustead, IJM Plantations is a majority-owned subsidiary of IJM Corporation. There is no cross-shareholding seen in the IJM business groups, but the pyramid ownership structure is clear between the two companies.

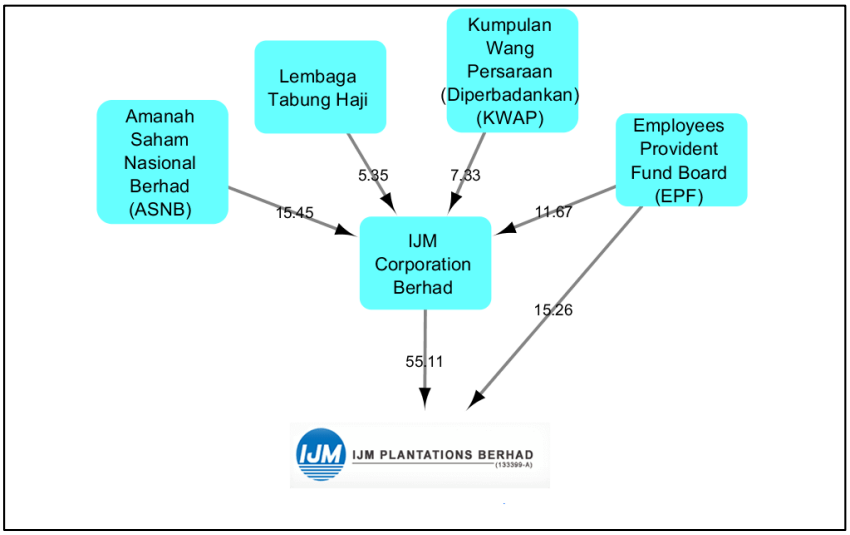

Figure 3.6: Percentage (%) of shareholdings (a directed network) by major shareholders in IJM Plantation

IJM Plantations Berhad entered a joint venture with Koperasi Pembangunan Desa in 1985 to develop Desa Talisai in Sabah. Since then, IJM Plantations' land bank in Sabah has been increasing and has expanded to Indonesia. They regard themselves as a 'boutique' oil palm agribusiness based in Sabah. IJM Plantations contributed 9% of the total IJM Corporation's total revenue. The biggest revenue contributor to IJM Corporation is the property business division with a 37% share (IJM Corp., 2015). Figure 3.7 shows the IJM Corporation's global reach. Plantations businesses are mainly in Indonesia and Malaysia.

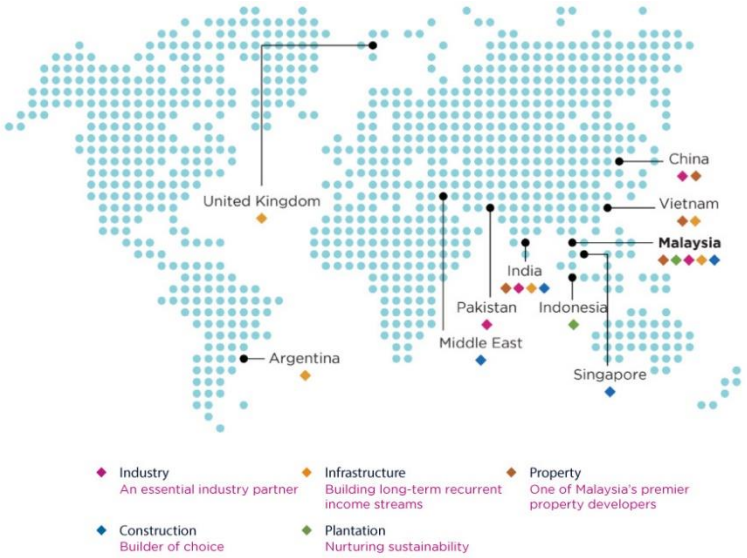

Figure 3.7: IJM Corporation's Footprint in 2017
(Source: IJM Corporation's official website,https://www.ijm.com/the-ijm-story)

Kulim (M) Berhad

As seen in Figure 3.8, Kulim (M) Berhad is 54.88% owned by Johor Corporation, the Johor state-owned investment company. Kulim is the only state-owned company studied in this research. However, the shareholdings pattern is similar to Sime Darby and Boustead.

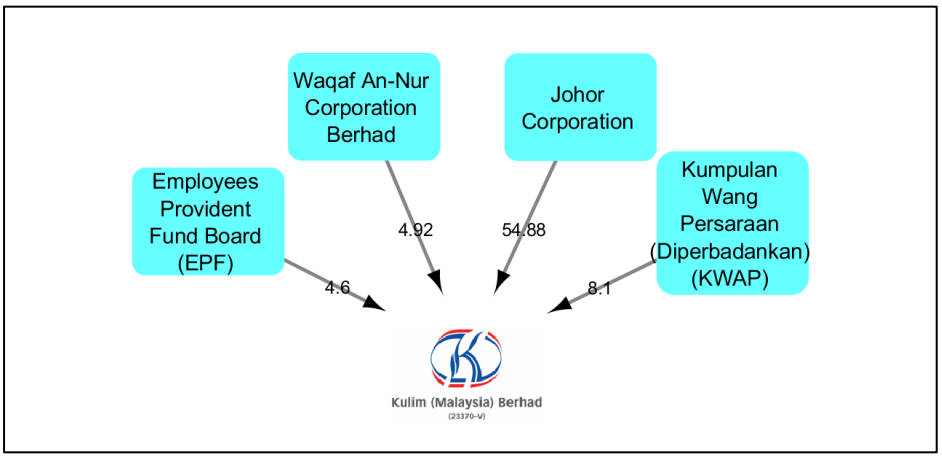

Figure 3.8: Percentage (%) of shareholdings (a directed network) by major shareholders in Kulim

The history of the company began with the incorporation of Kulim Rubber Plantations Ltd in 1933 in the United Kingdom. In 1947, the company started to

operate a rubber plantation in Johor state. Johor State Economic Development Corporation (now known as Johor Corporation) became a shareholder in 1976. The core businesses are: plantation, oil and gas, intrapreneur ventures, and agro-food. Figure 3.9 shows Kulim's global business footprint in 2013. The plantation segment of the business contributed 90% of the company's total revenue in 2013.

Figure 3.9: Kulim Berhad's Footprint in 2013
(Source: Kulim Berhad 2013 Annual Report)

IOI Corporation Berhad

As shown in Figure 3.10, IOI Corporations' (IOI Corp) major shareholder is Vertical Capacity Sendirian Berhad (44.67%), a private company owned by IOI Corporations' founder, Tan Sri Lee Shin Cheng. The strong control links is clear through Progressive Holdings in IOI Corporations through Vertical Capacity. There are three directors which hold shares in IOI Corporation, and they hold shares in Progressive Holdings. There is a clear cross-shareholdings structure in IOI Corporation through its directors.

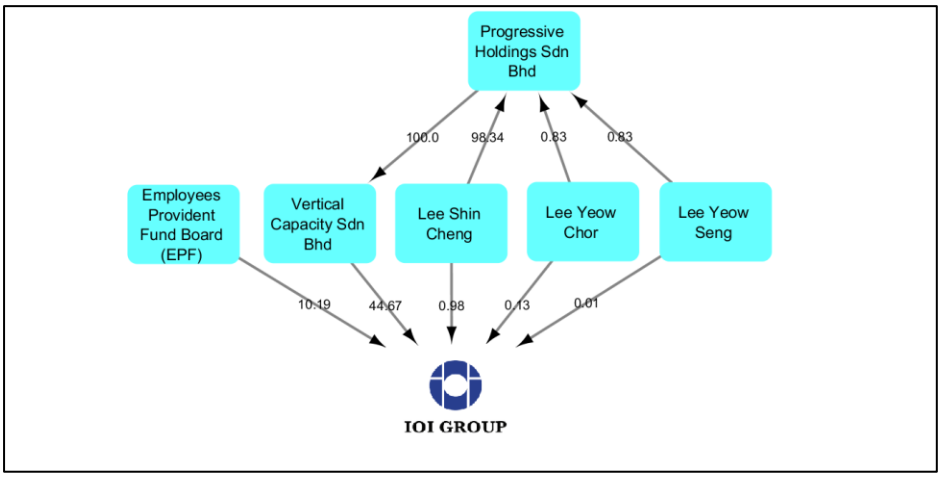

Figure 3.10: Percentage (%) of shareholdings (a directed network) by major shareholders in IOI Corporations

IOI Corp is under the IOI Group. IOI Corp is a fully integrated company involved in plantation and resource-based manufacturing. The company is among the largest plantation owners in the industry. The resource-based business focuses on oil refineries, the production of oleochemicals, and specialty oils and fats. In 2013, the revenue contributed to the group by its plantation segment is 41%. This is an increase from 21% inrom 2012. Its property segment is the second biggest revenue contributor to the group with 33%. Figure 3.11 illustrates the corporation's global presence. Plantation business is mainly in Malaysia and Indonesia.

IOI Corporation was incorporated in 1969 and was listed in 1980. It ventured into palm oil plantations in 1985. IOI Corporation is a fully integrated company in plantation and resource-based manufacturing. The resource-based business focuses on refineries, oleochemicals, and speciality oils and fats.

Figure 3.11: IOI Corporation's global presence
(Source: IOI Corporations 2013 Annual Report)

KL Kepong Berhad

The chart in Figure 3.12 shows that Kuala Lumpur Kepong Berhad (KLK) is 46.57% owned by Batu Kawan Berhad, an investment holding company. Batu Kawan Berhad is 47.73% owned by Arusha Enterprise which in turn is owned by Wan Hin Investments holding 77.4%. Wan Hin Investments' major shareholders are also the Directors at KLK. There is a distinct pattern in shareholdings ownership in KLK compared to IOI and other GLCs. There are four companies linked to Wan Hin Investments which is then linked with Arusha Enterprise. Two companies are directly owned by Lee Oi Hian, while the other two companies are owned by Lee Hau Hian. They are the sons of Lee Loy Seng, the founder of KLK.

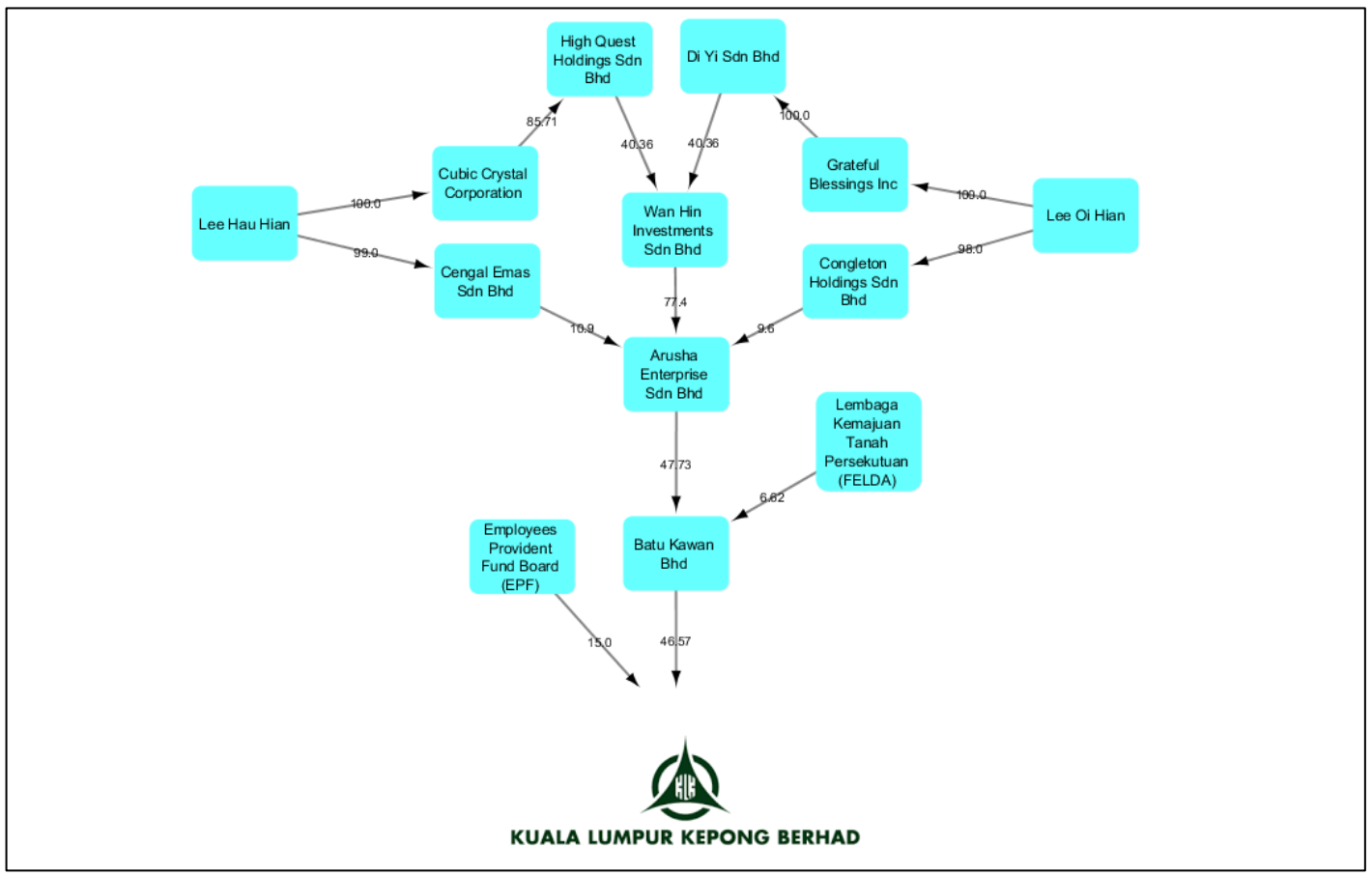

Figure 3.12: Percentage (%) of shareholdings (a directed network) by major shareholders in KL Kepong

KLK started as a plantation company more than 100 years ago. Today, the core business is still in plantation (oil palm and rubber) with oleochemicals manufacturing. Its business in the plantation sector contributed to 45% of the group's revenue in 2013, whilst manufacturing contributed 51% in 2013. Figure 3.13 shows the operation locations in 2017 for three main businesses, plantations, manufacturing and properties.

KLK started as Kuala Lumpur-Kepong Amalgamated Limited (KLKA) in 1960. Kepong (Malay) Rubber Estates Ltd. was acquired by the Kuala Lumpur Rubber Company Limited (incorporated in London) and formed KLKA. Lee Loy Seng, a tin miner's son from Ipoh, bought the KLKA's undervalued shares, and in 1970 its control, management and operations were transferred to Malaysia. In 1973, under the Scheme of Reconstruction, Lee Loy Seng was appointed as the Founding Chairman of KLK. It was listed on the Kuala Lumpur Stock Exchange in 1974. Today, the business is under the stewardship of the second generation of Lee's family. The core business is still in plantations (oil palm and rubber) besides oleochemicals manufacturing.

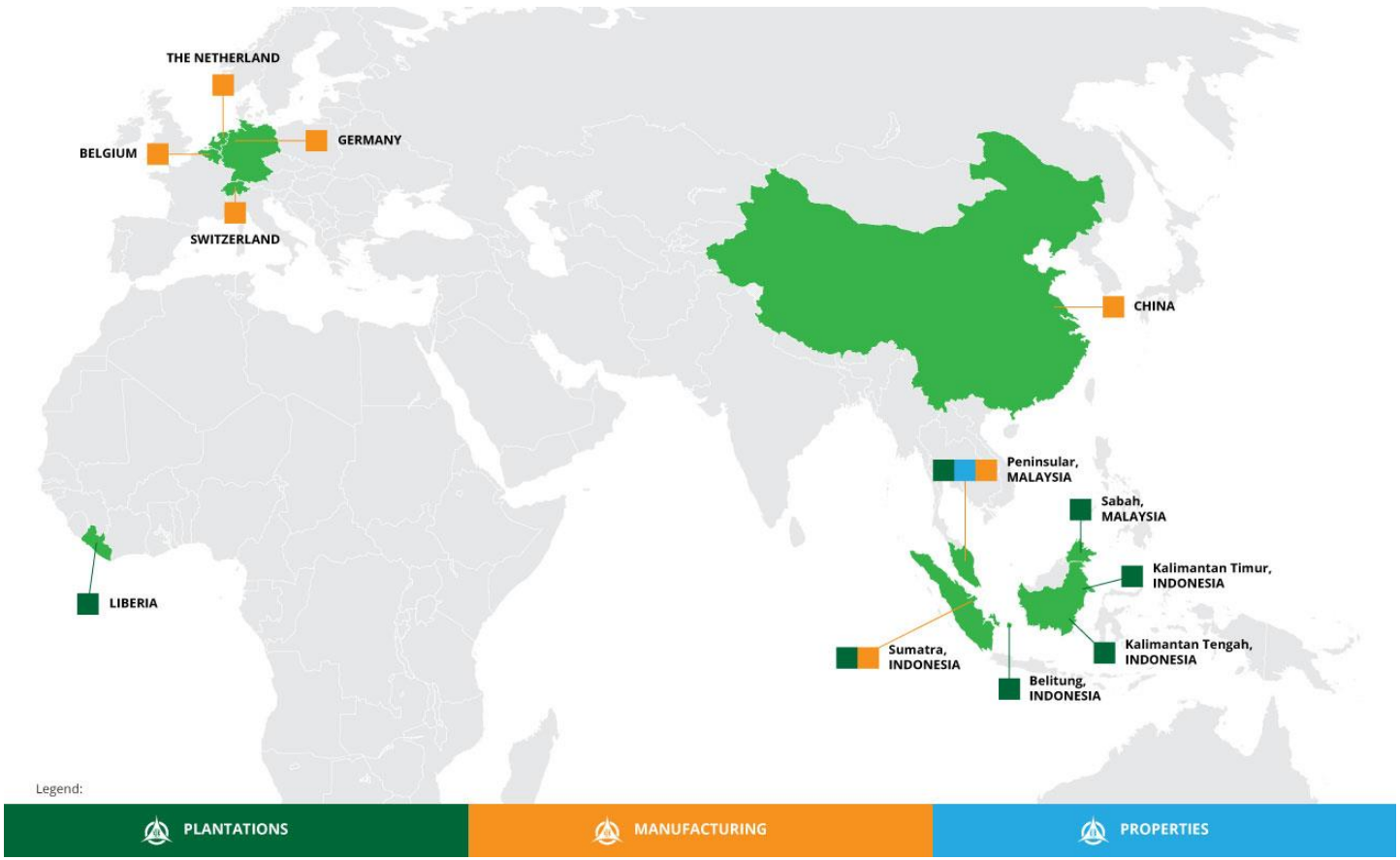

Figure 3.13: KL Kepong Berhad's 2017 locations of operations
(Source: KL Kepong official website, https://www.klk.com.my/company-profile/)

Genting Plantations

Genting Plantations is 53.55% owned by Genting Berhad as is evident in Figure 3.14. Genting Berhad is in turn owned by Kien Huat Realty Sdn Bhd with close to 39.52%. Kien Huat Realty is a private company that is held by Lim Goh Tong's (the Genting founder) family. Genting Berhad is the investment holding and management company of Genting Group. Kien Huat Realty is 94.2% owned by Parkview Management, and the shareholders of Parkview Management are Goh Tong's family.

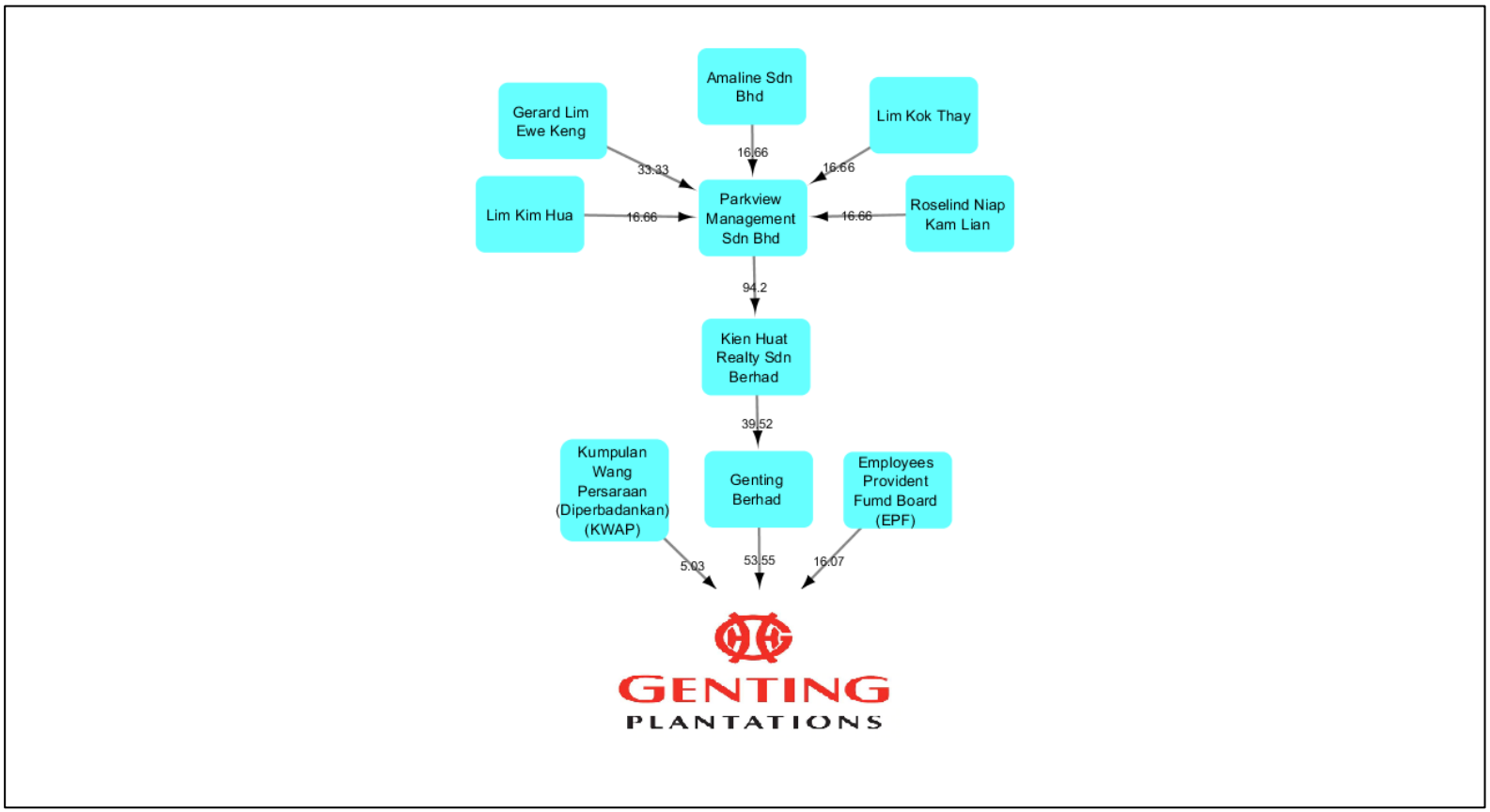

Figure 3.14: Percentage (%) of shareholdings (a directed network) by major shareholders in Genting Plantations

Genting Plantations and Genting Singapore PLC are subsidiaries under Genting Berhad. Genting Plantations was formerly known as Asiatic Development Berhad, one of the fastest growing plantation company. In 1980, Genting Plantations became a wholly owned subsidiary of Genting Berhad. Genting Berhad's plantation business is its leading core activity. Figure 3.15 shows the business locations in 2013. Genting Plantations has ventured into the property development and biotechnology industries. In 2013, Genting Plantations contributed 8% of the total group's revenue. Genting Malaysia Berhad was the largest contributor with 49%. Genting Malaysia Berhad is involved in the leisure and hospitality business.

Genting Highlands Berhad was founded in 1965. Genting Highlands Berhad expanded from its hotel and resort business to plantations, power generation, and oil and gas exploration. Genting Plantations was listed in 1982 and has ventured into property development and the biotechnology industry.

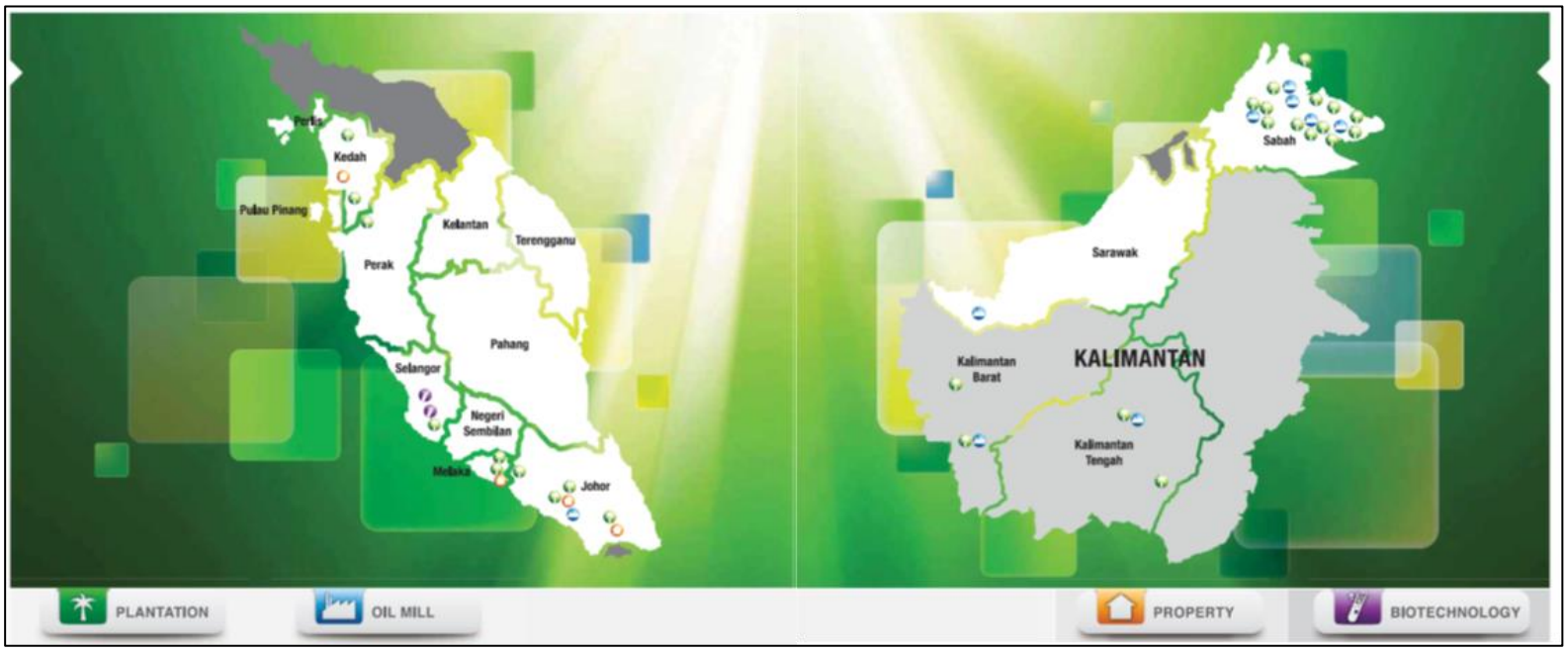

Figure 3.15: Genting Plantation's oil palm business locations in 2013
(Source: Genting Plantations 2013 Annual Report)

Jaya Tiasa Berhad

Jaya Tiasa Holdings Berhad is 21.37% owned by Tiong Toh Siong Holdings (Figure 3.16). Tiong Toh Siong Holdings is in turn owned by Tiong Hiew King and his family. Genine Chain Limited and Asanas Sdn Bhd also owns Jaya Tiasa holding 9.41% and 9.02% respectively. Since Asanas is wholly owned by Genine Chain, this shows a circular shareholding pattern within Jaya Tiasa.

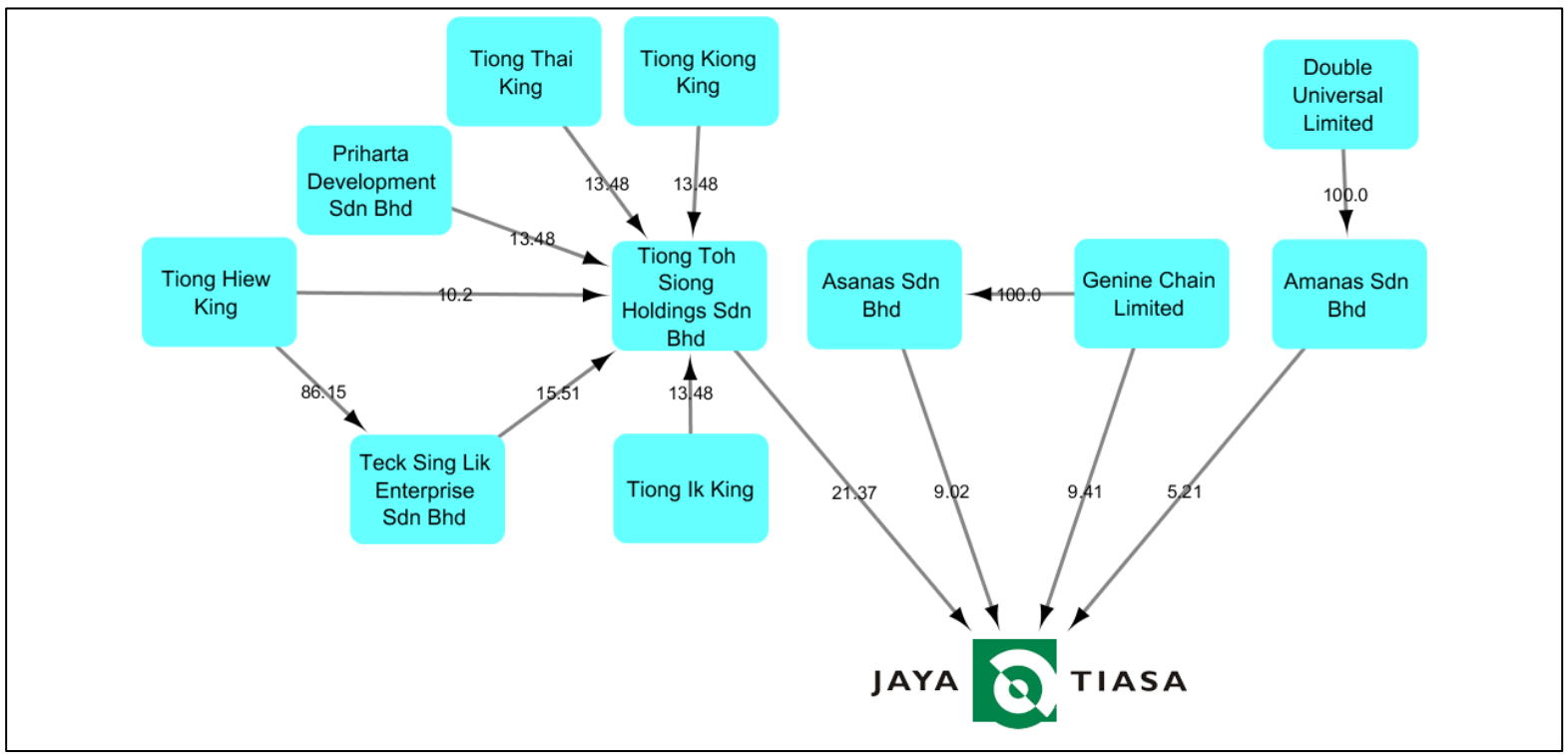

Figure 3.16: Percentage (%) of shareholdings (a directed network) by major shareholders in Jaya Tiasa

Jaya Tiasa Holdings Berhad is a fully integrated timber producer in Malaysia. The principal activities are investment holding, oil palm plantation and crude palm oil milling, and timber products manufacturing. In 2013, 25% of the total revenue came from oil palm operations, and 75% came from timber operations.

Jaya Tiasa Holdings Berhad is one of the prominent members of the Rimbunan Hijau Group. In 1993, Berjaya Textiles Bhd was sold to Tiong Hiew King, the founder of Rimbunan Hijau Sdn Bhd. In 1995, Berjaya Textiles Bhd changed its name to Jaya Tiasa Holdings Berhad whose headquarters is located in Sibu, Sarawak. Its shares were publicly listed on the Kuala Lumpur Stock Exchange in 1997. Jaya Tiasa Holdings Berhad is a fully integrated timber producer. Its principal activities are investment holding, oil palm plantations and crude palm oil milling, and timber products manufacturing. Figure 3.17 shows the land area spreading over 10 plantations for Jaya Tiasa oil palm business in Sarawak.

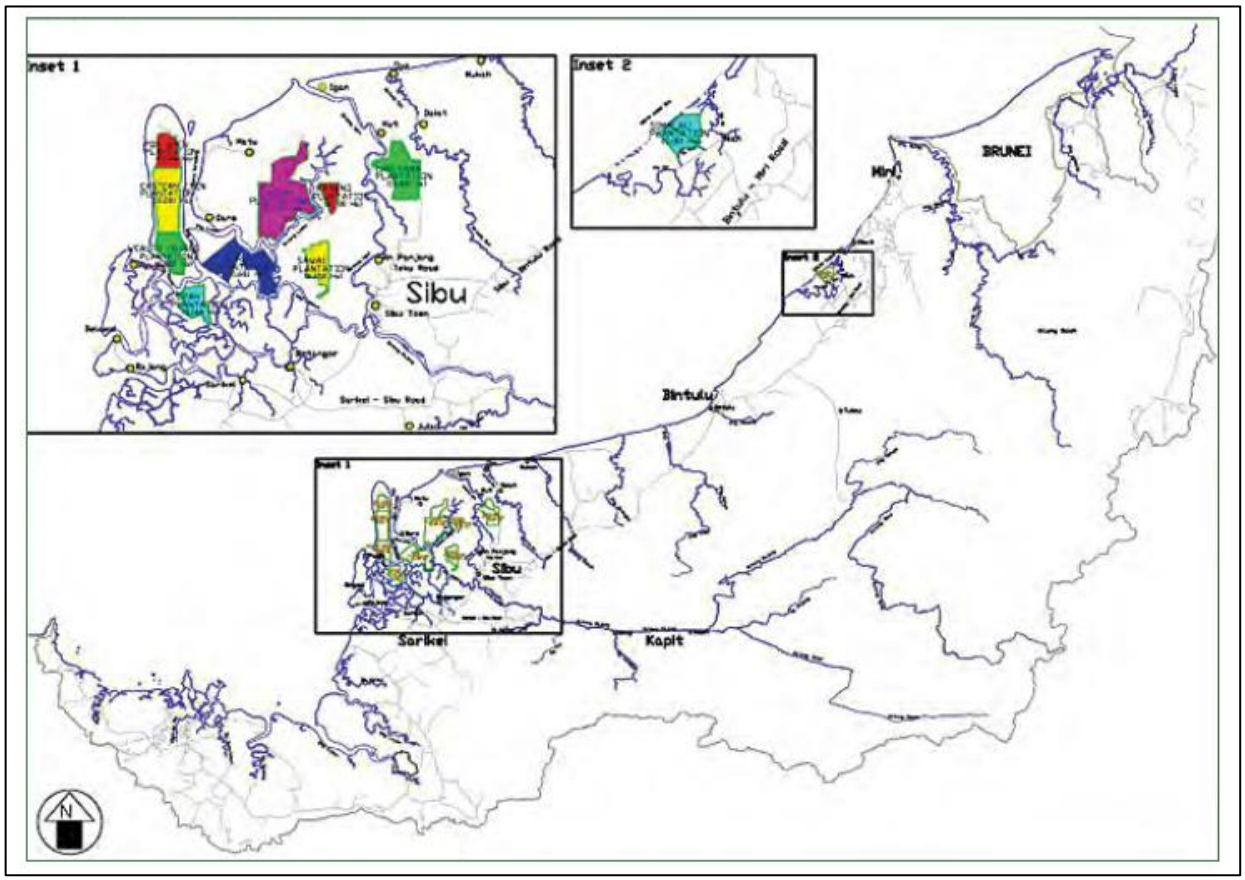

Figure 3.17: Jaya Tiasa's oil palm business division
(Source: Jaya Tiasa 2017 Annual Report)

3.3 Data Analysis

The shareholdings data gathered from the various sources were exported to Cytoscape, an open source network analysis software. There are other softwares available to compute social analysis and network metrics, such as Pajek and Gephi (Bastian, Heymann, & Jacomy, 2009; de Nooy, Mrvar, & Batagelj, 2005; Smoot, Ono, Ruscheinski, Wang, & Idekar, 2011). Cytoscape was used for this study for its heavy-duty capabilities in the handling and visualisation of large amounts of data (Roda et al., 2015).

The below figure (Figure 3.18) illustrates the main work process for data analysis in this research. It started with the shareholdings data collection, then to data input to Cytoscape software for the network analysis. The data was arranged according to the format accepted by the software. Network Analyzer analysed the shareholdings data and provides individual metrics for each company, as well as for the main holding corporation as a group metrics. Both individual and group metrics were further analysed using statistical test. Scatterplot matrix were employed to discover which of the metrics has significant relationship and meaning. Based on the results in scatterplot matrix, the significant metrics were further analysed using statistical test and linear regression to get a clearer and precise analysis of the metrics relationship. On top of that, the research analysed the results visually using default network layout and hierarchical layout to supplement the statistical test results.

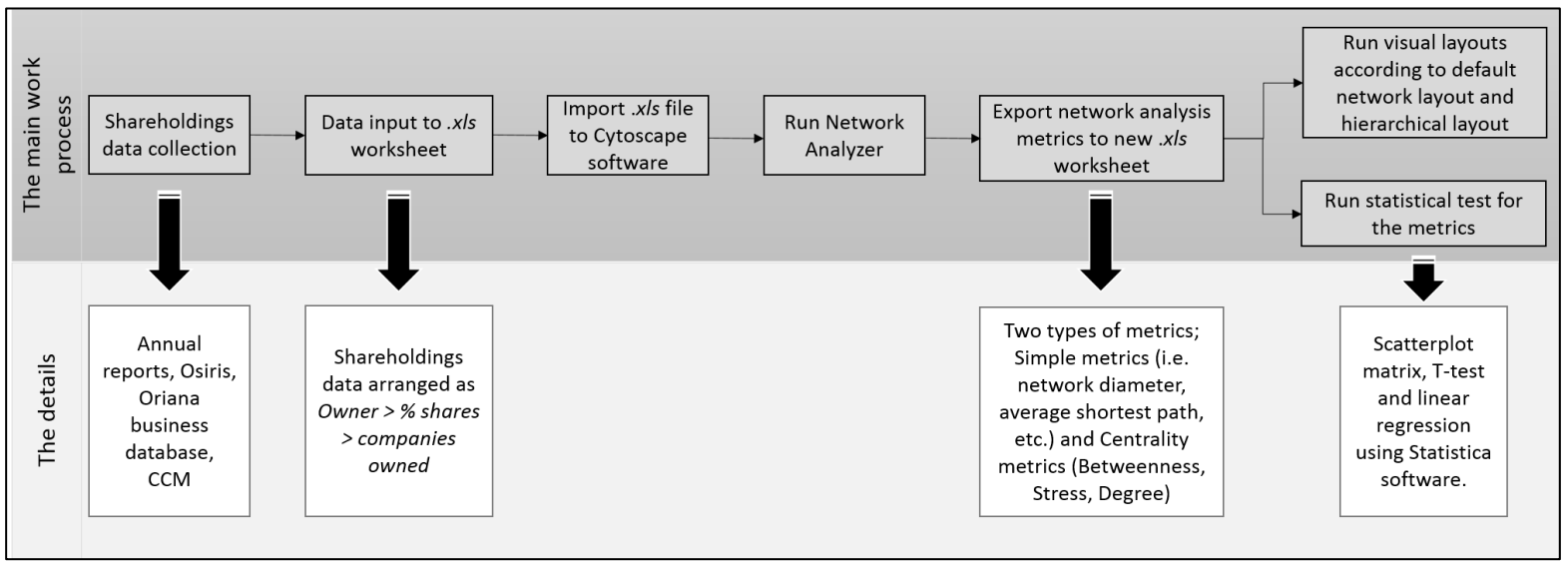

Figure 3.18: Work process for data analysis

3.3.1 Network analysis

Based on the previous Figure 2.2 (page 57), a node represents a company or an individual who owned shares in the corporation. An edge represents the percentage of shares owned by the company or the individual. The central node is the main corporation. A cluster is a group of companies that have cross-shareholdings. These perspectives are helping to break down the complexity of companies' interconnectedness in their shareholdings structure. In the context of this study, companies and shareholders are the nodes, and the link between them is shareholdings. Network analysis can help us to understand the concentration of power and decision-making within the business group.

Since the ownership and control structure of palm oil corporations are complex, the study integrated the data analysis with the network tool which is able to uncover the shareholdings complexities. Uncovering the person/entity who makes the decisions in a group is not easy due to this complexity. According to Cross, Liedtka and Weiss (2005), through the analysis of social networks, a study can obtain important information by uncovering the actual ownership structure of the company.

Cytoscape is a software that is able to analyse data into network interaction visuals and analysis. It is an open source platform, started in 2002. Although the software was originally designed for biological research, now it evolved into a general platform for complex network analysis and visualisations. The software provides a basic set of data integration, analysis and visualisations features. It also has Applications, knows as Apps, as additional specific features for the users. This study employed the Cytoscape version 3.4, and analyse the data using Network Analyzer which is built in as the basic set feature. Network Analyzer analysed the centralities metrics, Betweenness and Stress, among other simple network metrics, from the shareholdings data.

In this research, the shareholdings data were visualized in two types of layouts. Firstly, the default network layout where the nodes indicate the company in the corporation, and the edges indicate the amount of shares owned. The edges were colour coded, red (91-100%), orange (61-90%), yellow (30-60%), and green (less than 30%). The layout shows the topology of the corporation's ownership structure and gradient of shares concentration within the corporation. Secondly, the hierarchical layout where the nodes were arranged hierarchically based on the shares owned through the edges. The layout demonstrates the pyramidal level of the corporation. Both of these layouts can be discussed further by referring to the network metrics, as shown in the above Table 3.3.

3.3.2 Statistical analysis

Statistical analysis were divided into three parts; (i) the correlation matrix of the network metrics, (ii) the t-test for the significant network metrics, and (iii) linear regression modelling. Three analysis were carried out to compare and discuss the relationship of the network metrics in the ownership structure and the decision-making behaviour of the eight corporations.

Correlation matrix

After exporting the data into Cytoscape, the NetworkAnalyzer generated a range of network centrality metrics. To understand the relationship between network centrality metrics, a correlation matrix was drawn for all the network metrics generated by NetworkAnalyzer in Cytoscape. There are eleven network metrics that were correlated, as shown in Figure 3.12. They are; average shortest path, clustering coefficient, closeness, eccentricity, stress, betweenness, neighbourhood connectivity, outdegree, indegree, radiality, and eigenvector. Based on the correlation result, betweenness and stress (outlined in red) show a striking pattern of a linear relationship. The research decided to further analyse the betweenness and stress metrics.

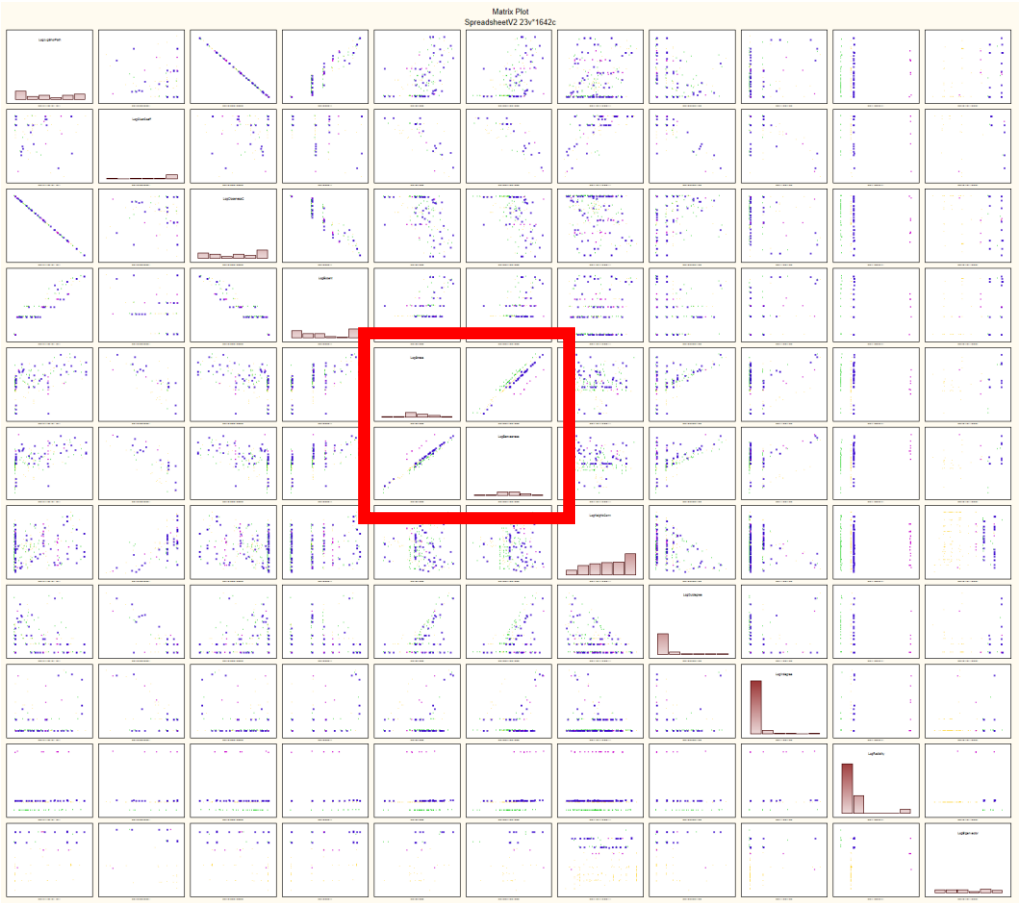

Figure 3.19: Correlation matrix scatterplot for network metrics

T-test

The metrics were tested for the t-test to understand the differences and similarities of the decision-making behaviour among the eight companies. The purpose of t-test is to test the level of difference between the companies. The test was made for betweenness and stress metrics, and the slope and the intercept of the linear regression. Based on the t-test results, the research made detail inferences on the decision-making behaviour differences and similarities among the corporations.

Simple linear regression

A linear regression model was developed (equation 3.3) to quantify and provide a more in-depth understanding of betweenness (structural control) and stress relationship (decisions' load). The model is the indicator for predicting the decision-making behaviour of the corporations.

$$\text{Structural control (C)} = \text{function of decisions' load (S)} \qquad 3.3$$

(I) Local model

The model was applied to all eight corporations individually (equation 3.4). This model is classified as local models as it applied to each company's dataset. Each local model has separate values of *a* (slope) and *b* (intercept) for each company. Therefore, the model gives eight different values of slopes (*a*) and eight different values of intercepts (*b*). We regard *a* and *b* as "local parameters".

$$\text{C corp} = \text{f}(\text{Si corp}, a \text{ corp}, b \text{ corp}) \qquad 3.4$$

$$\text{C corp} = a + b\ (\text{Si corp}) \qquad 3.5$$

where,

C_i^{corp} = Structural control of an agribusiness corporation
a^{corp} = slopes
b^{corp} = intercepts
S_i^{corp} = Decisions' load of an agribusiness corporation
i = a subsidiary/shareholdings unit

The local models infer the individual firms' decision-making behaviour. A single explanation is crucial to understanding firms' behaviour. It would be more impactful if we could unite the local models to a global or common model, which able to represent all companies with a single notion.

(II) Global model

The global model is applied to one dataset that represents all firms'. The local model parameters were studied to identify the possibility of developing a global model. Based on the local model regression results, it was found that all slopes

have a similar value, close to 1 (Refer Chapter 5, Table 5.4). This suggests that it is possible to develop a global model.

In a global model, there is only one value of the slope (*a*), for all corporations while having eight values of intercepts (b). The global model is:

$$C_i^{corp} = f\,(S_i^{corp},\ a,\ b^{corp}) \qquad 3.6$$

The study generalised the writing of the model as:

$$C_i^{corp} = f\,(S_i^{corp},\ a\ global,\ b\ local) \qquad 3.7$$

where:

C_i^{corpx} = structural control of agribusiness corporations
a = slope for all agribusiness corporations
b^{corpx} = intercept of an agribusiness corporation
S_i^{corpx} = decisions' load of agribusiness corporations
i = a subsidiary/shareholdings unit

The study regards *a* as a "global parameter" because it has the same value for all corporations. However, we still have b^{corp1} to b^{corp8} as local parameters. Overall, the model has become a global model since it has, at least, one global parameter.

These parameters in the global model explain the decision-making behaviour for each company as well as for the whole group.
The differences between global and local model are

CHAPTER 4

OWNERSHIP STRUCTURE TOPOLOGY

This chapter highlights the answers related to the question of attributes of the ownership structures of GLCs and FOBs that inform decision-making control. It also emphasises the similarities and differences of the GLCs' and FOBs' ownership structures.

The first section presents the topology metrics that describes each of the government- and family-owned companies' ownership structure. It presents the network topology graphs in two layouts. The first layout is a star-topology and the second is a hierarchy-topology. Both layouts highlight different analyses.

The second section deals with comparison of the topology metrics of the ownership structure for GLCs and FOBs as a group. It presents both GLC and FOB network layouts on a bigger scale, to analyse the similarities and differences between and within GLCs and FOBs.

The third section presents the results and analysis for the whole agribusiness and plantation sector in Malaysia. It compares the GLCs and FOBs as a group.

4.1 Company's Share Ownership Structure

4.1.1 Government-linked Companies

Each network topology has a feature revealed by the network metrics. The network topology metrics presented in the tables in the following section are selected for discussion. Whilst there are many other network metrics computed in the network analysis, these simple metrics are chosen based on its suitability to this research's scope. Betweenness and stress will be discussed in the next chapter as they are categorised as advanced metrics. The discussion focuses on each company.

The detailed definitions of the metrics are in Table 3.3 (Chapter 3). To summarise briefly, network diameter shows the business groups' pyramidal tiers. Average ownership tier indicates the ownership tier by a company in the business group. The bigger the tier, the longer the flow of the decision-making. Subsidiaries degree display the number of subsidiaries owned by the main holding company. The more subsidiaries the company has, the wider the decision-making control in the structure. Shareholdings degree shows the number of shareholders by the main holding company. The more shareholders the company has, the more

viewpoints or influence it has over the decision-making (Glattfelder, 2010). Hierarchical index indicates the level of hierarchy in the business group structure. The higher the hierarchical index, the longer the decision-making flow is. The number of nodes represents the number of companies in the business group which is involved in this research. The bigger the number of companies, the heavier the decision-making's load in the main holding company.

Sime Darby Berhad

Based on results in Table 4.1, Sime Darby Berhad has nine pyramid tiers. Each company in Sime Darby has 1.4 tier of ownership which reflects a small flow of decision-making. It reduces the possibility of inefficiency in the decision-making control, as it has one-to-one control. It has the most extensive subsidiaries degree among all GLCs. It exhibits the heavy load of the main holding company when the level of ownership is short but the subsidiaries degree is big. Sime Darby has 29 shareholders, relatively low among the GLCs. It indicates low influence in the decision-making control by the shareholders. The hierarchical index shows the extent of the hierarchies in the company. Sime Darby is 92% hierarchic, which is considered as very hierarchical. This is reflective in the pyramid level of the network. The more pyramidal, the higher the hierarchical index. The number of nodes are the number of companies visualised in the network. The structural properties showed by the network topology metrics is imbalanced, which leads to discrepancies in its decision-making control.

Table 4.1: Sime Darby network topology metrics

Network metrics/ Company	Network diameter	Average ownership tier	Subsidiary degree	Shareholdings degree	Hierarchical index	No. of nodes
SIME DARBY	9	1.44	499	29	92%	736

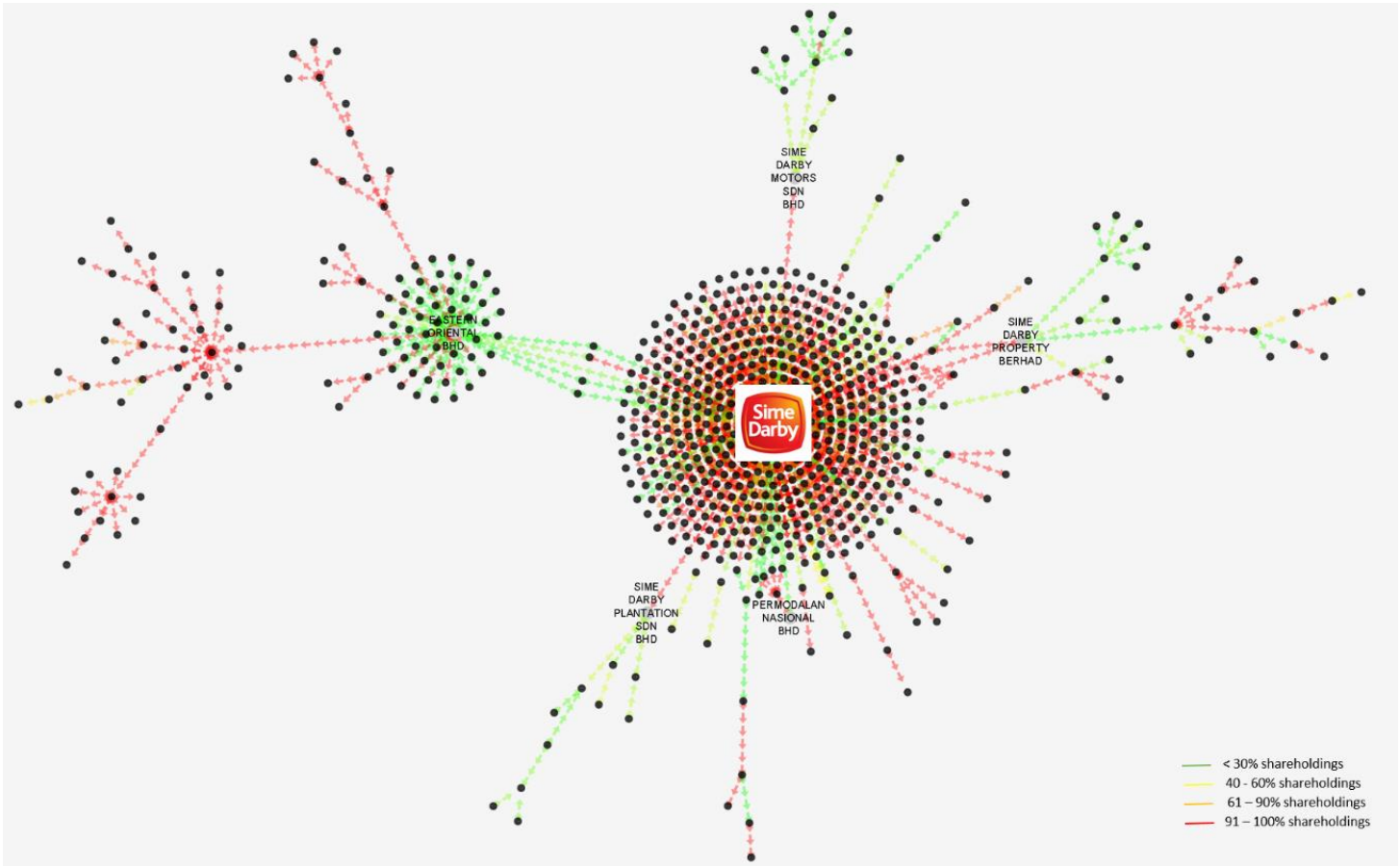

Figure 4.1: Sime Darby shareholdings ownership topology using prefuse network layout

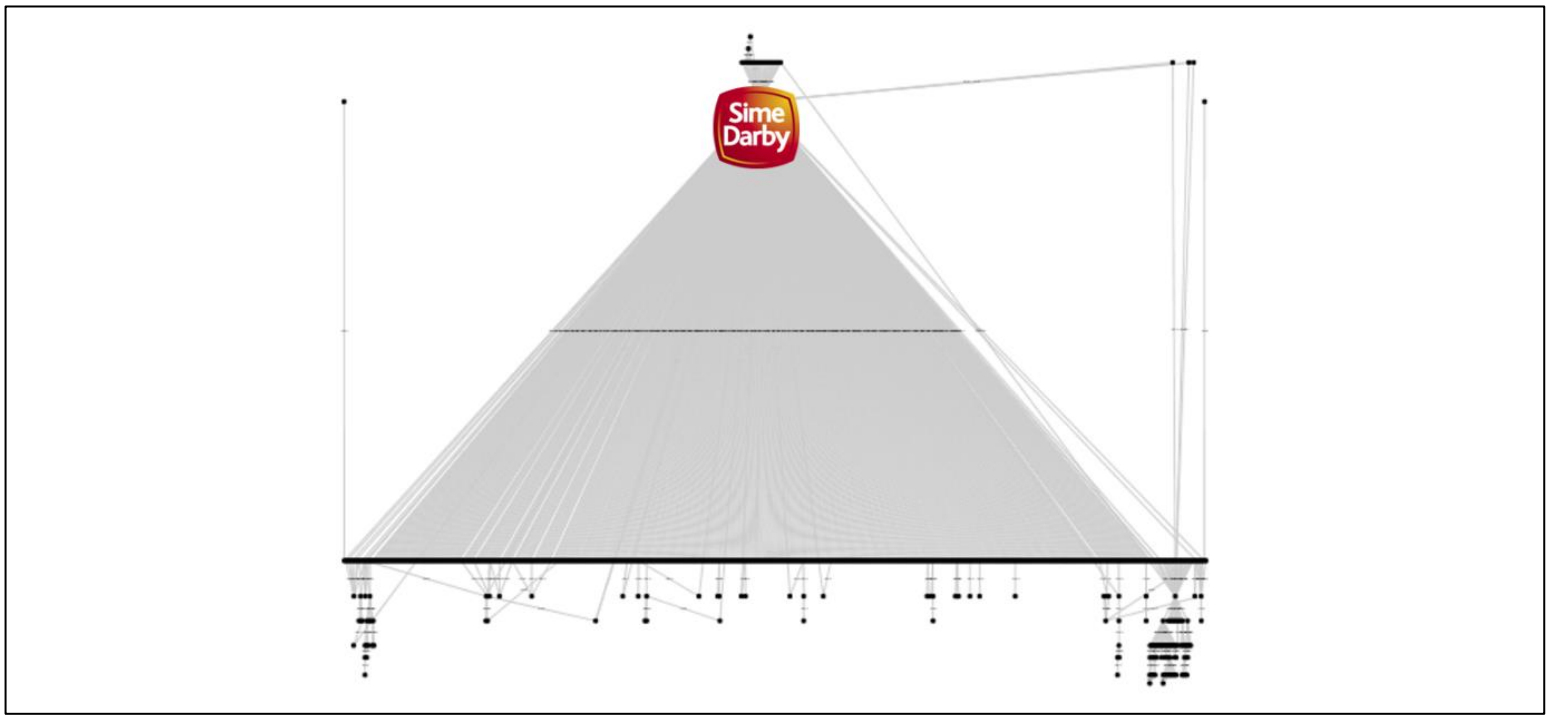

Figure 4.2: Sime Darby shareholdings ownership using hierarchical layout

Figures 4.1 and 4.2 show the topology network structure for Sime Darby Berhad. Figure 4.1 illustrates that most of the subsidiaries are concentrated at the core company, Sime Darby Berhad. It shows that the decision-making process and control are very much centralised at the main holding company, as Sime Darby is a highly diversified business group. From the topology structure above, it is clear that the decision-making control comes from the main holding company at the centre.

From Figure 4.1, it is clear that Permodalan Nasional Berhad (PNB) holds high control through its investment schemes in Amanah Saham Nasional Berhad (ASNB). ASNB holds a fraction of the ownership for PNB through various schemes. However, in total PNB holds 45.15% of ownership in Sime Darby, which makes it the substantial shareholder that may hold a higher amount of control/influence in the company's decision-making.

Sime Darby's topology also shows a cluster group of companies. The only public-listed company here is Eastern & Oriental Berhad (E&O), a construction and property development company. E&O was ranked 98 in 2013 in Bursa's top 100 list by market capitalisation. Sime Darby bought 30 percent of E&O in August 2011 from Tham Ka Hon and GK Goh Holdings Ltd, a Singaporean company. In July 2013, Sime Darby had 31.96 percent of E&O's equity. However, in 2016, Sime Darby disposed of its shares in E&O, with Tham re-emerging as a major shareholder.

The companies in the cluster that are non-publicly listed are: Sime Darby Plantations, Sime Darby Property and Sime Darby Motors. Sime Darby Berhad, as a holding company, is at the top of the hierarchical structure for these four subsidiaries.

Figure 4.2 shows that Sime Darby Berhad is a highly centralised firm as the hierarchical index is 92%. The higher hierarchical index means the companies have many layers of hierarchy in its structure. It makes the holding company highly centralised and heavy in manoeuvring the whole group in synergy. Sime Darby, which was founded in 1910 and is the largest plantation business group in Malaysia in terms of market capitalisation is a global player in the agribusiness sector. It operates in 26 countries through more than 500 subsidiaries through five sectors: plantation, motors, property development, industrial, energy and utilities. This explains the highly centralised and hierarchical structure of the company. The element of cross-shareholdings is not seen in the flagship. The shareholding is straightforward as can be seen in Figure 3.1 in Chapter 3.

Boustead Holdings Berhad

Results in Table 4.2 shows that Boustead Holdings has 11 pyramid tiers, the highest among the GLCs. This could be due to its vast diversification of business activities across the economic sectors. The bottom most companies have to take

11 steps to reach the top holding company. The table shows a wide network coverage. Boustead's companies have 4 levels of ownership compared with other companies, the highest among the GLCs. It shows a longer flow of decision-making. It has the second largest subsidiaries degree among all GLC companies, but still very much lower than Sime Darby. It reflects the lighter load of decision-making as the main holding group. Boustead has the largest shareholdings degree value, showing that the influence of shareholders in the decision-making may be higher. Boustead Holdings is 94% hierarchic, the highest hierarchical structure among GLCs. It also has the largest number of companies visualised in the network. Based on these features, Boustead has a heavy decision-making load as a diversified main holding company in various economic sectors.

Table 4.2: Boustead network topology metrics

Network metrics/ Company	Network diameter	Average ownership tier	Subsidiary degree	Shareholdings degree	Hierarchical index	No. of nodes
BOUSTEAD	11	4.00	93	44	94%	1350

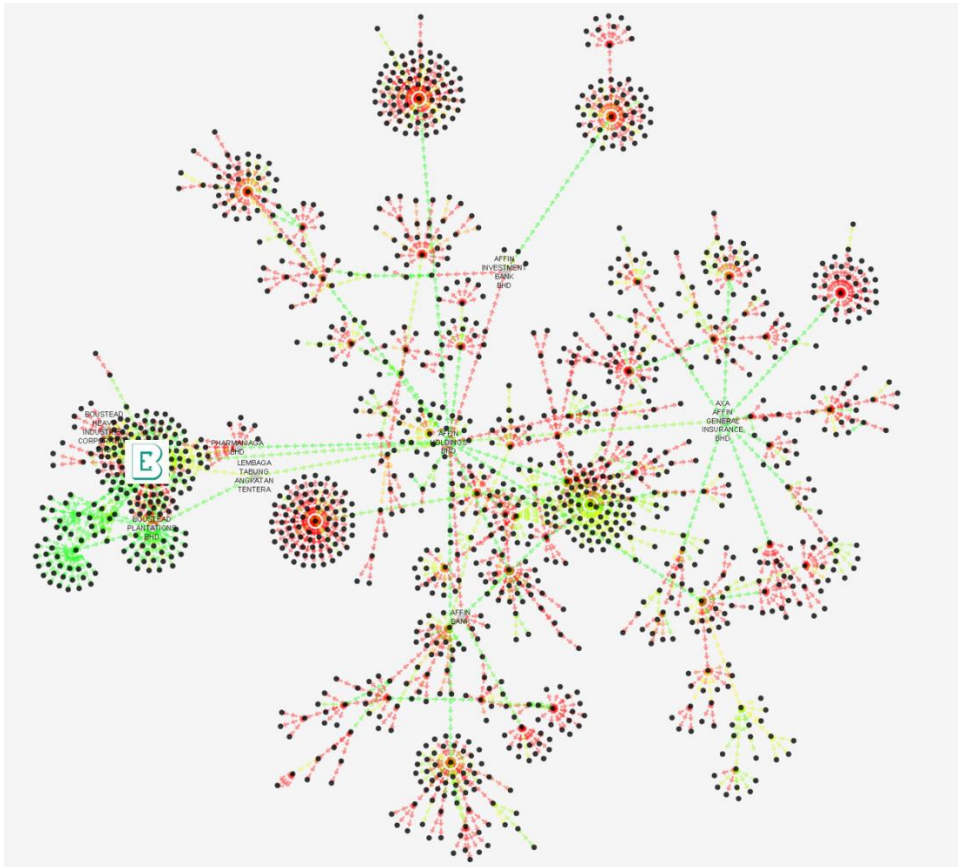

Figure 4.3: Boustead Holdings shareholdings ownership topology using prefuse network layout

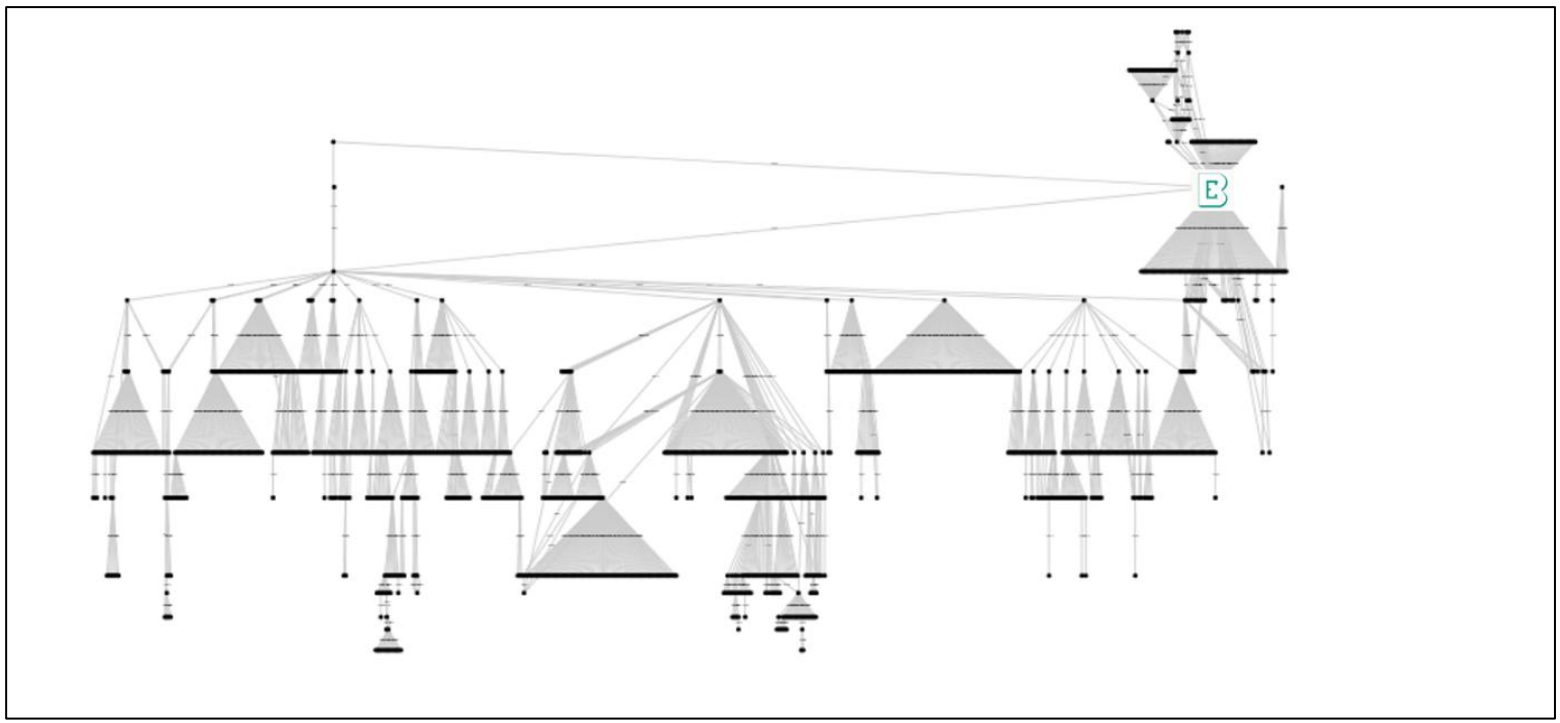

Figure 4.4: Boustead Holdings shareholdings ownership using hierarchical layout

In Figure 4.3, it can be seen that most of the companies are spread throughout the network, forming many clusters. Boustead Holdings as the holding company owns majority shares in other public-listed companies, Pharmaniaga, Boustead Heavy Industries Corporations and Boustead Plantations. Lembaga Tabung Angkatan Tentera (LTAT) holds 59% share in Boustead Holdings Berhad, the largest block shareholder among all GLCs studied in this thesis. It is evident that LTAT is the key player in terms of decision-making within this group. It started in 1990, when LTAT held a majority interest in Boustead Holdings and Affin Holdings. In 2011, LTAT acquired, through Boustead, Malaysia's largest integrated local healthcare company and generic pharmaceuticals manufacturer, Pharmaniaga. Almost all other companies in the LTAT group are private enterprises in a diverse range of sectors such as plantations, communications and biotechnology (Gomez et al., 2017).

In 2013, Boustead held 21% ownership while LTAT held 35% of Affin Holdings Berhad. Affin Holdings is wholly owned by Affin Bank. Affin Holdings Berhad, one of the leading financial services provider, is a majority shareholder of Affin Bank group and owned a few other companies in various industries. Affin Bank, Affin Investment Bank Berhad, and AXA Affin General Insurance Berhad are the major subsidiaries of Affin Holdings which subsequently lead to the spread of clusters and sub-clusters in Boustead's group network.

This proves the existence of cross-shareholding within the LTAT–Boustead Holdings–Affin Holdings network. It shows that the decision-making process is crucial at LTAT and Boustead Holdings as they own a similar group of companies. While Boustead is not as huge as Sime Darby in terms of market capitalisation, through its ownership ties with LTAT, it is associated with Affin Holdings, a key player in the financial sector, making it an equally important corporate entity in Malaysia.

IJM Plantations Berhad

Table 4.3 shows that IJM Plantations has eight tiers of the pyramid in its structure. It is relatively lower than Sime Darby and Boustead because IJM Plantations is a subsidiary of IJM Corporation. The companies within IJM Plantations have a 2.4 level of decision-making flow, larger than Sime Darby which has 1.4 level. The size of its subsidiaries is 79, very much less than Sime Darby, but not as much as Boustead. The shareholdings degree is 33, slightly higher than Sime Darby, showing the moderate influence of shareholders in the decision-making control. IJM Plantations is 84% hierarchic, which is not so high compared to the other GLCs with a similar size. It has 421 companies visualised in the network. Based on the topology metrics, IJM Plantations is reasonably proportionate compared to Sime Darby and Boustead. This could be due to its feature as the subsidiary of IJM Corporation, whilst both Sime Darby and Boustead are main holding companies.

Table 4.3: IJM Plantations network topology metrics

Network metrics/ Company	Network diameter	Average ownership tier	Subsidiary degree	Shareholdings degree	Hierarchical index	No. of nodes
IJM Plantations	8	2.41	79	33	84%	421

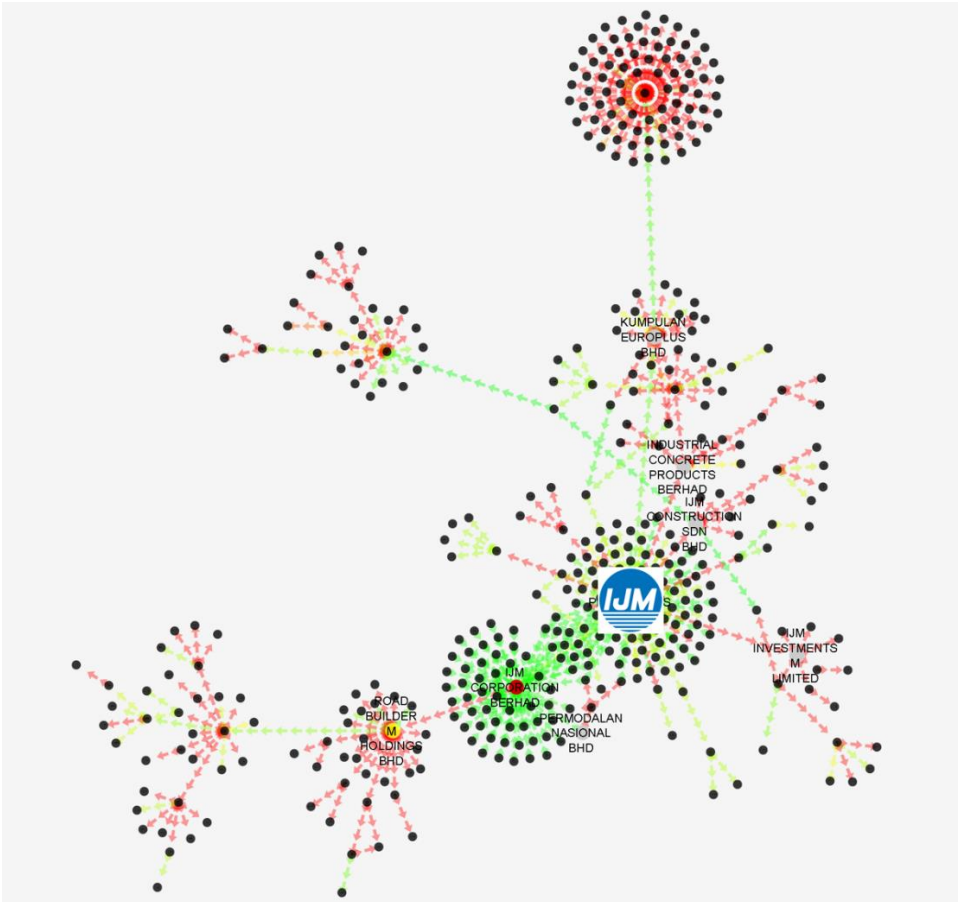

Figure 4.5: IJM Plantations shareholdings ownership topology using prefuse network layout

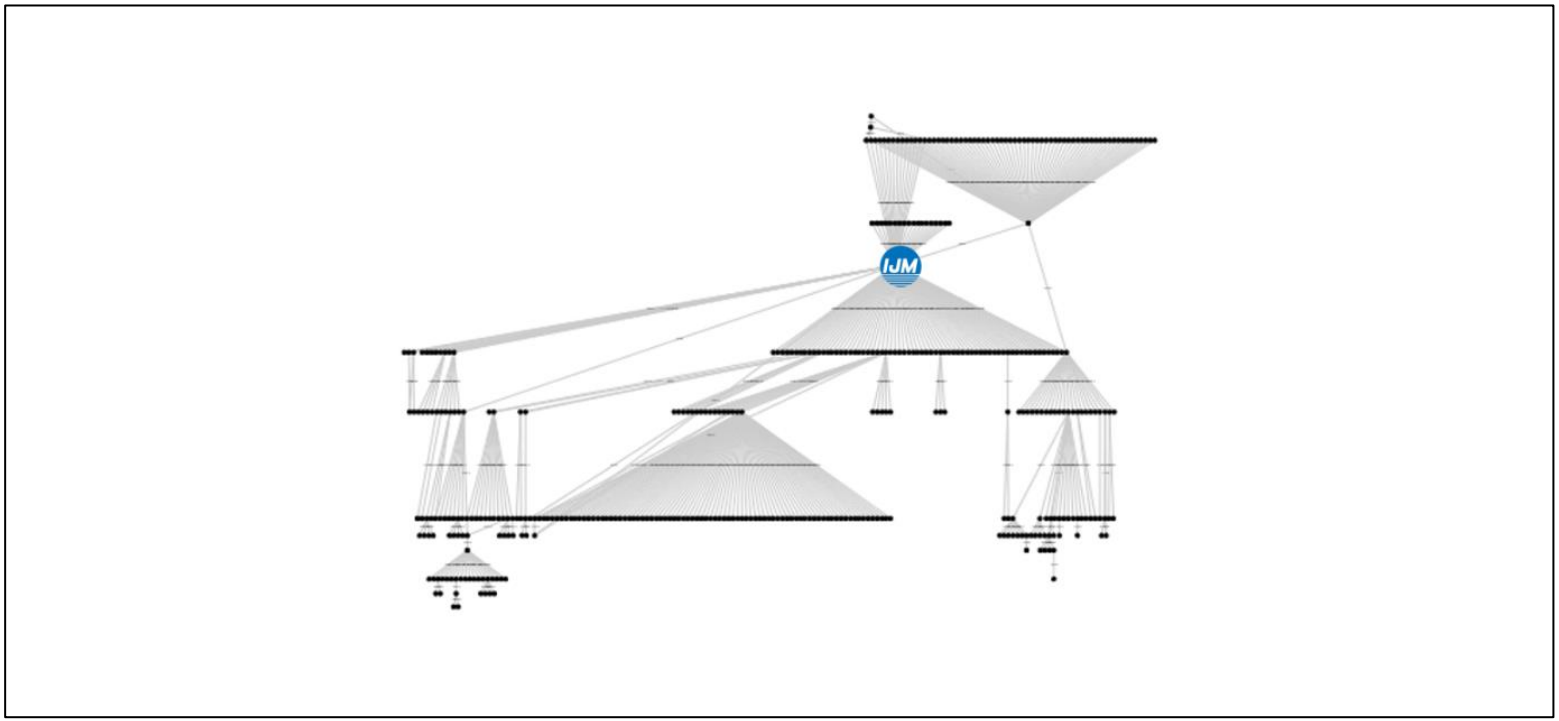

Figure 4.6: IJM Plantations shareholdings ownership using hierarchical layout

Referring to Figure 4.5, it can be seen IJM Plantations is majority owned by its holding company, IJM Corporations. IJM has an incredibly complex interlocking stock ownership pattern as this group has interests in three public-listed companies: IJM Corp, IJM Land and IJM Plantations. The major shareholder in IJM Corporations is PNB, whose stake is through the ASNB's various trust fund schemes.

IJM Corp owns Road Builder (M) Holdings, which then created a cluster within the network. IJM Plantations owns a majority stake in Industrial Concrete Products Bhd, IJM Construction Sdn Bhd and IJM Investments (M) Limited. Cross-shareholding can be seen at the subsidiaries level.

IJM Corp is a substantial shareholder of IJM Plantations, with a 55.1 percent stake. The Sabah state government has a 4.62 percent stake in IJM Plantations through a private firm, Desa Plus Sdn Bhd. In 1985, IJM Plantations entered a project to develop estates in Sabah. Since then, its land bank in Sabah has increased, expanding to Indonesia. The company regards itself as a "boutique" oil palm agribusiness in Sabah. IJM Plantations was listed on the Bursa's main board in July 2003.

Kulim Berhad

Results in Table 4.4 shows that Kulim has four layers in the pyramidal structure, the least among all GLCs in the plantations sector. Its companies have two levels of ownership of other companies, making it larger than Sime Darby. Its subsidiaries size is 20, the smallest among all GLCs. The shareholdings degree is 27, which shows the low influence of the shareholders. Kulim is 81% hierarchic, also the least among all GLCs. It has 101 companies visualised in the network. Based on the topology metrics, Kulim is smaller than the other three GLCs. Its structure shows the features of a lean structure, which could have an efficient flow of decision-making. This could be due to its feature as a state-owned GLC compared to the other three companies, which are owned by the federal government GLICs that have a higher amount of investments and higher social obligations.

Table 4.4: Kulim network topology metrics

Network metrics/ Company	Network diameter	Average ownership tier	Subsidiary degree	Shareholdings degree	Hierarchical index	No. of nodes
KULIM BERHAD	4	1.96	20	27	81%	101

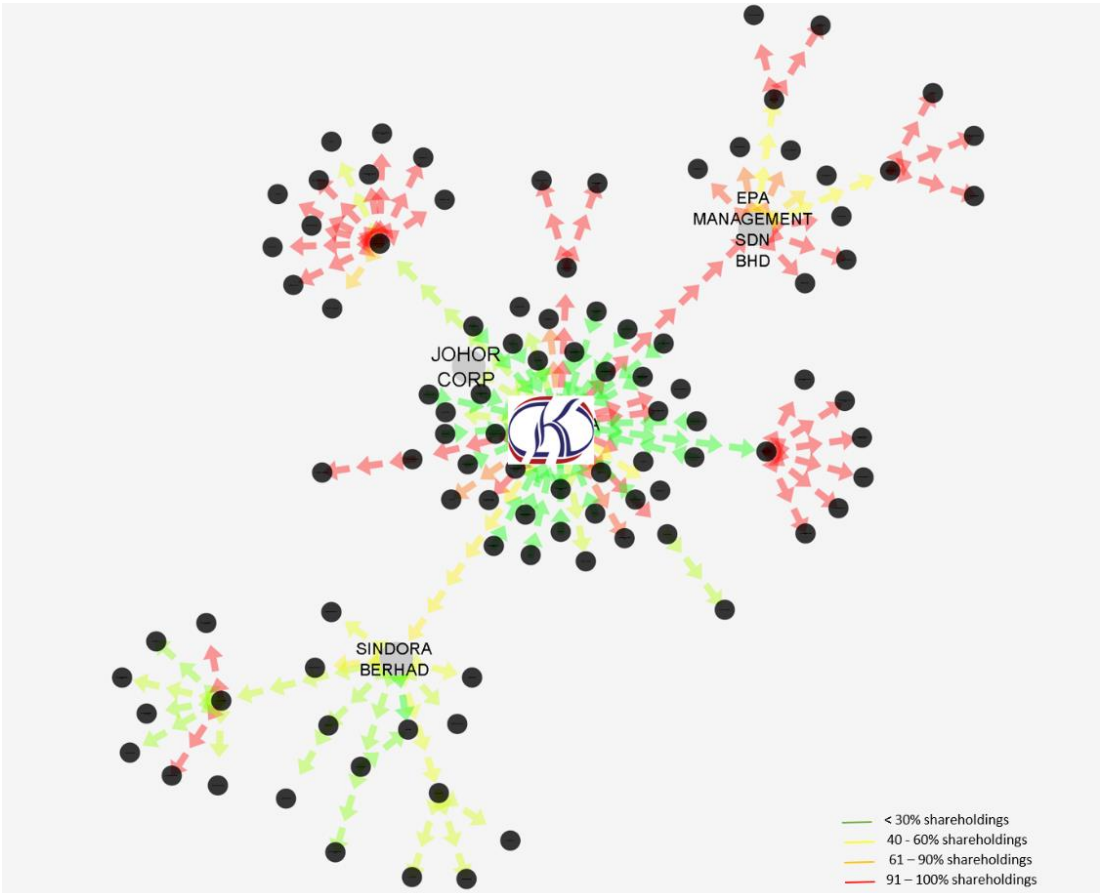

Figure 4.7: Kulim Berhad shareholdings ownership topology using prefuse network layout

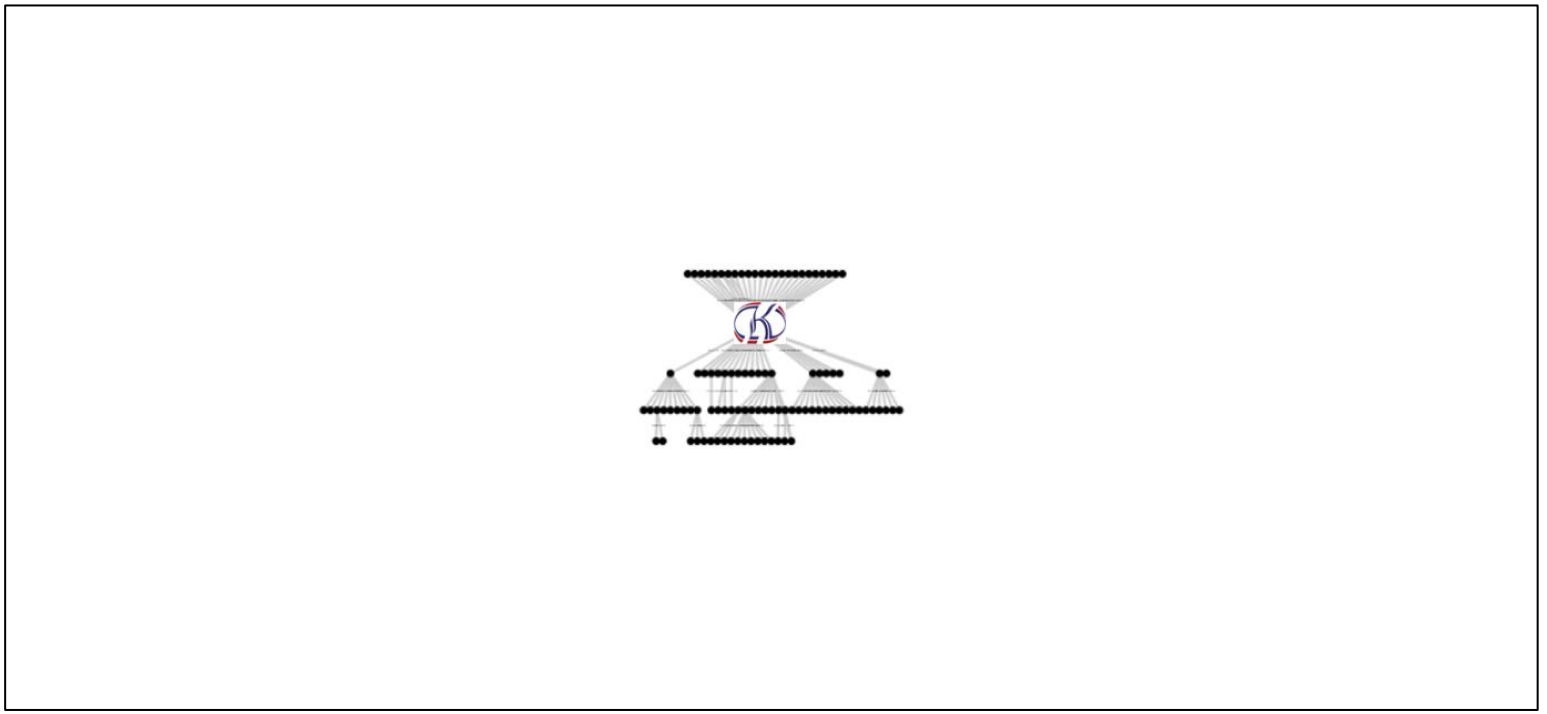

Figure 4.8: Kulim Berhad shareholdings ownership using hierarchical layout

Kulim is a majority owned (55%) company of Johor Corporation, a state-owned investment agency. Johor Corp's ownership of Kulim was a result of a takeover. Figure 4.8 shows shareholdings ownership by Kulim. The ownership structure is smaller compared to three other plantations company, Sime Darby, Boustead and IJM Plantations. There are only two big business groups which are majority owned by Kulim. It wholly owns EPA Management, an investment holding providing management services and consultancy, and a mechanical equipment assembly company. Kulim owns Sindora Bhd with 77% share. Sindora's business is in investment holding, and operations of oil palm and rubber estates. Kulim has a lean ownership structure, compared to the other government-owned plantations companies.

4.1.2 Family-owned companies

The network metrics results are presented in Tables 4.5 to 4.8. The discussion focuses on each of the family-owned companies.

Kuala Lumpur-Kepong Berhad

Referring to Table 4.5, KLK has 12 layers in its pyramidal structure, the largest among all FOBs. This could be due to their diversification in business and its main holding company, Batu Kawan Berhad. KLK's companies have three levels of ownership of other companies, reflected in three levels of flows in the decision-making process. Its subsidiaries size is 116, the largest among all the FOBs. The shareholdings degree is 43, the most among the FOBs. It indicates a high level of influence by the shareholders in decision-making. Despite having the most shareholdings degree, KLK is 81% hierarchic, the second least hierarchical among all the FOBs. It suggests that the size of the shareholdings degree does not reflect the decision-making control in KLK. It has 520 companies visualised in the network, the second largest among the FOBs.

Based on the topology metrics, KLK is the largest among the other three FOBs. However, they have managed to keep their hierarchy level relatively low compared to other companies with similar size. It indicates that KLK's decision-making control is fairly distributed across the company's network. The subsidiaries have some level of autonomy in business decision-making.

Table 4.5: KL Kepong network topology metrics

Network metrics/ Company	Network diameter	Average ownership tier	Subsidiary degree	Shareholdings degree	Hierarchical index	No. of nodes
KLK	12	3.06	116	43	81%	520

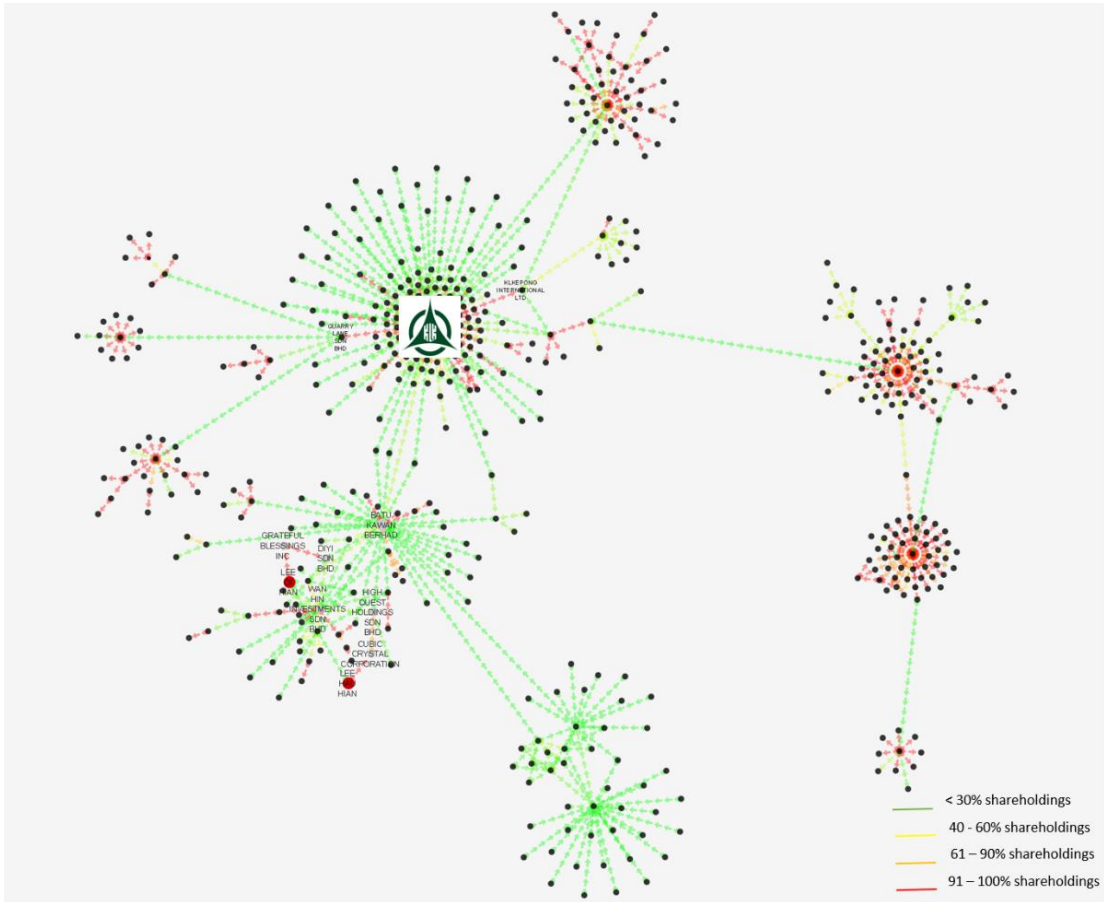

Figure 4.9: KL Kepong Berhad shareholdings ownership topology using prefuse network layout

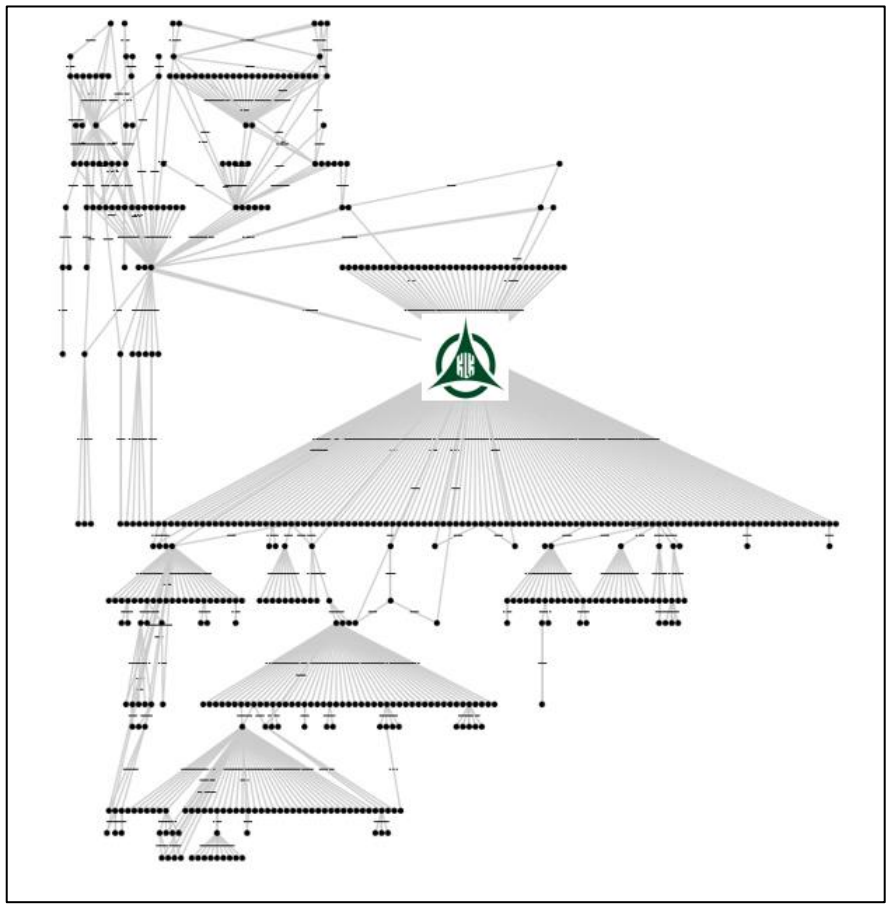

Figure 4.10: KL Kepong Berhad shareholdings ownership using hierarchical layout

Figure 4.9 shows that KLK Berhad's ownership structure has an indirect link to the ultimate owner, Batu Kawan Bhd and Arusha Enterprise. Batu Kawan is an investment holding company with the majority of its investments in chemical manufacturing, transportation, property development and plantations. Arusha Enterprise is also an investment company.

KLK Bhd owns two large business groups, KL Kepong International Ltd and Quarry Lane Sdn Bhd. KL Kepong International Ltd owns Synthomer PLC with 11% while KLK Bhd owns 8%, making it the biggest block shareholder in Synthomer group besides directors' interests. Synthomer is formerly known as Yule & Catto and Co., a British-based chemical business. They are the world's dominant supplier of lattices and specialty emulsion polymers in coatings, construction, textiles, paper, and synthetic gloves segment. Quarry Lane Sdn Bhd is wholly owned by KLK. These two subsidiaries formed an extensive network of clusters within the KL Kepong network.

Batu Kawan has eight subsidiaries. KL Kepong Bhd is its biggest subsidiary. Batu Kawan is owned by Arusha Enterprise which is in turn owned by Wan Hin Investments Sdn Bhd, as seen in Figure 3.6 in Chapter 3. Wan Hin Investments is jointly owned by Diyi Sdn Bhd (40%) and High Quest Holdings Sdn Bhd (40%). High Quest is majority owned by Cubic Crystal Corporation (86%). Cubic Crystal Corporation is wholly owned by Lee Oi Hian. Lee Oi Hian and Lee Hau Hian have minority shares in Wan Hin Investments. Cubic Crytal is wholly owned by Grateful Blessings Inc, an investment holding company incorporated in the British Virgin Islands. Grateful Blessings is wholly owned by Lee Oi Hian.

IOI Corporations Berhad

IOI Corp has 11 layers in its pyramidal structure, the second largest among the FOBs (Table 4.6). It is assumed that for every strategic decision made, it needs to go down to 11 levels in the structure to reach to the bottom. IOI Corp has the most levels of ownership compared to other companies. It suggests that every company within IOI Corp has three levels of flow in the decision-making. It has 74 subsidiaries, relatively smaller than KLK which is more pyramidal and has more number of companies. The shareholdings size is 36, smaller than KLK and Genting Plantations. It shows moderate influence in decision-making by the top shareholders. However, IOI Corp is 93% hierarchic, the highest among the FOBs. It is proposed that IOI Corp's decision-making control is more centralised than KLK. Both IOI Corp and KLK have a similar number of companies, but the respective hierarchy levels varies. IOI Corp has 639 companies visualised in the network, making it the largest FOB in this research.

Table 4.6: IOI Corporation network topology metrics

Network metrics/ Company	Network diameter	Average ownership tier	Subsidiary degree	Shareholdings degree	Hierarchical index	No. of nodes
IOI	11	3.32	74	36	93%	639

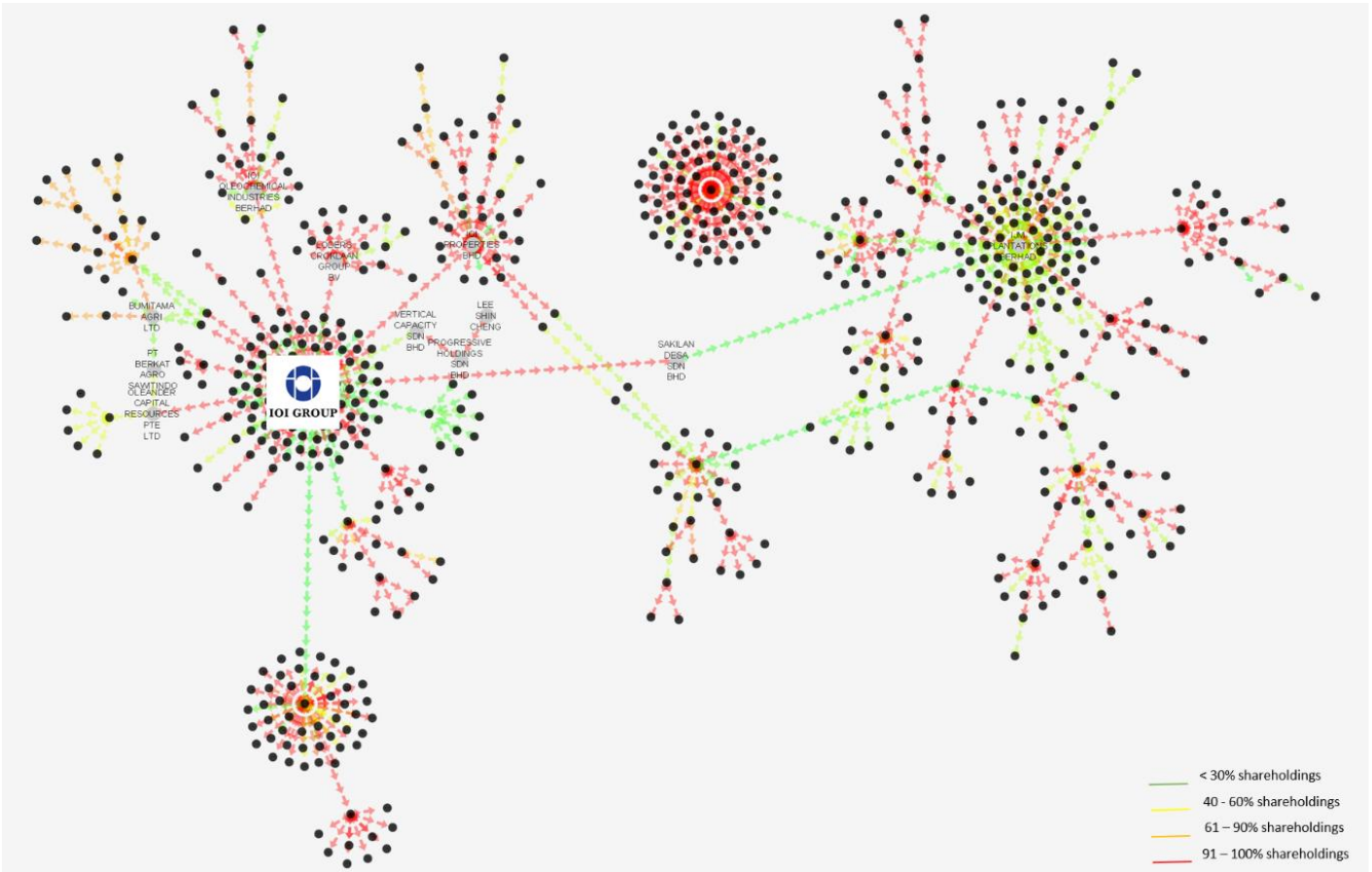

Figure 4.11: IOI Corporations Berhad shareholdings ownership topology using prefuse network layout

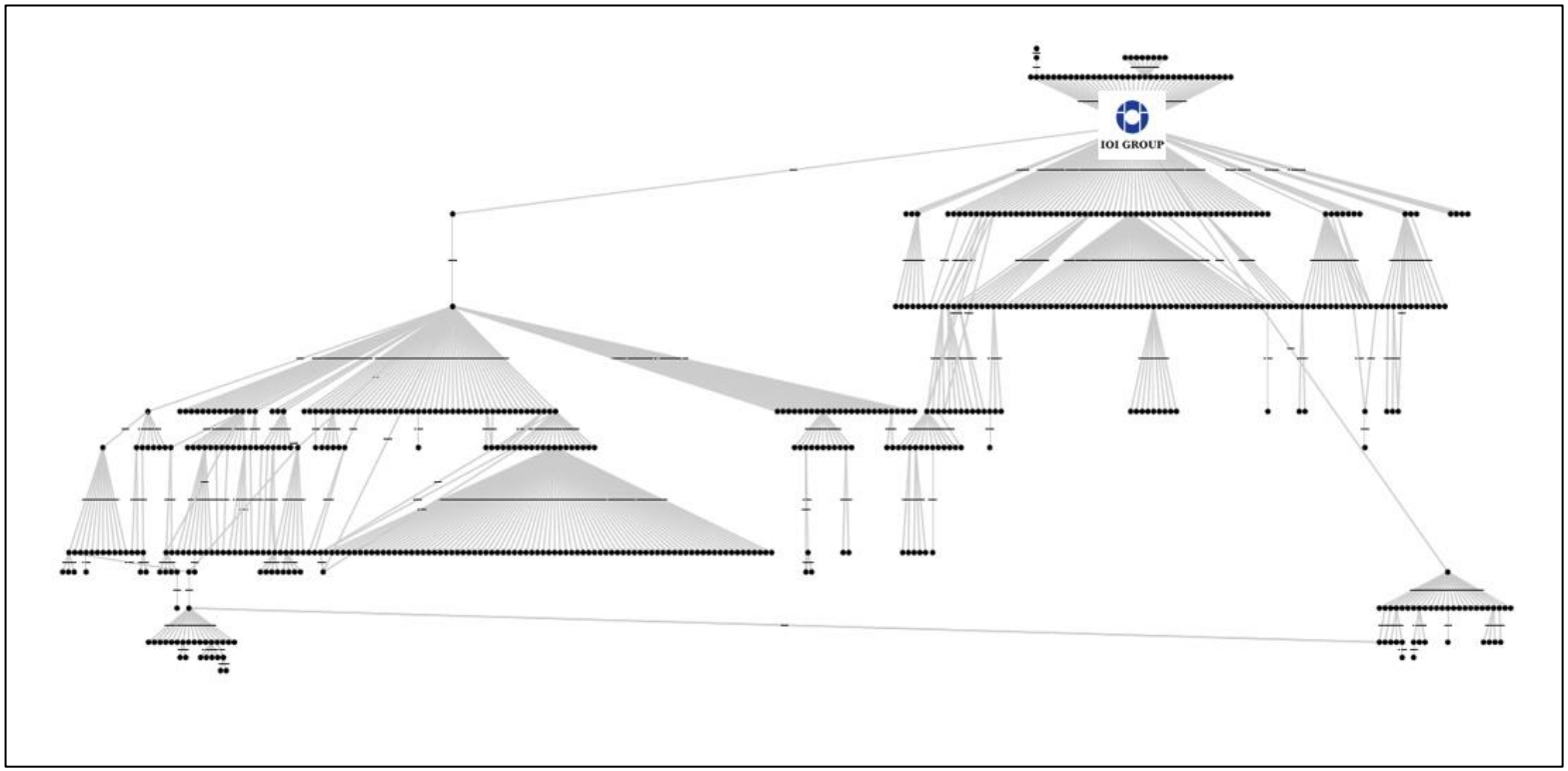

Figure 4.12: IOI Corporations Berhad shareholdings ownership using hierarchical layout

Figure 4.11 shows that Vertical Capacity Sdn Bhd is the majority shareholder in IOI Corporation. Lee Shin Cheng is the founder of IOI Corporation and owns Progressive Holdings Sdn Bhd which owns Vertical Capacity Sdn Bhd. Lee Shin Cheng's ownership of Progressive Holdings Sdn Bhd gives him high control in IOI Corporations' business decision-making.

Four principal subsidiaries extend from the clusters and sub-clusters in the network. They are: IOI Properties Group Bhd, Loders Croklaan Group, IOI Oleochemicals Industries Bhd, and Oleander Capital Resources Pte Ltd.

IOI Properties Group Berhad is one of Malaysia's leading public-listed property developers. It has built a solid reputation as the esteemed property arm of IOI Group before its successful listing on the Main Board of the Malaysian Stock Exchange on 15 January 2014. Today, IOI Properties Group Berhad is renowned as one of the largest property companies in the country with a proven track record spanning more than three decades in the property development industry. Its principal activities include property development, property investment, leisure and hospitality. It has successfully developed sustainable townships in sought-after regions of the Klang Valley and Johor in Malaysia while embarking on property developments in Singapore and the People's Republic of China. The company currently has a total of 10,000 acres of land bank in Malaysia and abroad.

Another subsidiary, Loders Croklaan Group, currently known as IOI Loders Croklaan, is the leading producer of premium quality oils and fats. The company's journey began in the 1800s with two distinct companies: the Dutch Crok & Laan and the British Loders & Nucoline, both successful in vegetable oils and fats. Unilever acquired Crok & Laan in 1970 and merged it with its subsidiary Loders & Nucoline, and Loders Croklaan was established. In 2002, the company was sold to the Malaysian IOI Group, which is active in palm oil plantations, oleochemicals, real estate development, and downstream manufacturing.

Today, IOI Loders Croklaan focuses on palm oil lipid solutions and is renowned for technological breakthroughs. With various state-of-the-art processes such as fractionation, interesterification, emulsification, IOI Loders Croklaan is well positioned to deliver a unique functionality and value to the end product. In 2010 they opened a state-of-the-art refinery in Rotterdam, which is the world's first large-scale refinery that uses the process of enzymatic interesterification. IOI Corp has divested 70% of its shares in Loaders Croklaan to Bunge Ltd in September 2017 (Hanim, 2017). It indicates that IOI Corp's structure would have had a lighter decision-making load due to the significant amount of divestment.

IOI Oleo Chemicals Industries Bhd started from zero-base in 1980. The humble but bold initiative was pioneering the palm-based oleochemical industry in the world. With the inception of their inaugural manufacturing facility, they were then the first and only oleochemical plant that produces palm-based oleochemicals

exclusively. Today, the Oleochemical Division of IOI Corporation is the leading producer of vegetable oil-based fatty acids. Its production capacity per annum is approximately 710,000MT. The manufacturing facilities are suitably located in Prai and Pasir Gudang.

The fourth and last subsidiary, Oleander Capital Resources Pte Ltd is a foreign private investment holding company. It owns PT Berkat Agro Sawit Indo, an associate company under Bumitama Agri Ltd. Bumitama Agri Ltd is a public-listed company and the leading palm oil producer in Indonesia.

Genting Plantations Berhad

Table 4.7 shows that Genting Plantations has nine layers in the pyramidal structure. It has one level of ownership, among the smallest in the FOBs. Its subsidiaries size is 77, relatively small compared to KLK and IOI Corp. This could be due to its sole focus on plantation related businesses, as the other business sectors are under the main holding group, Genting Berhad. The shareholdings size is 38, slightly less than IOI Corp. It suggests the shareholdings degree showed that the invested capital in this company is high and it may affect the influence in the decision-making. Given its smaller size of subsidiaries, Genting Plantations is 90% hierarchic, higher than KLK the largest pyramid, in terms of subsidiaries and shareholdings degree. It reflects that the decision-making control is centralised at the Genting Plantations group. It has 483 companies visualised in the network.

Table 4.7: Genting Plantations network topology metrics

Network metrics/ Company	Network diameter	Average ownership tier	Subsidiary degree	Shareholdings degree	Hierarchical index	No. of nodes
GENTING	9	1.03	77	41	90%	483

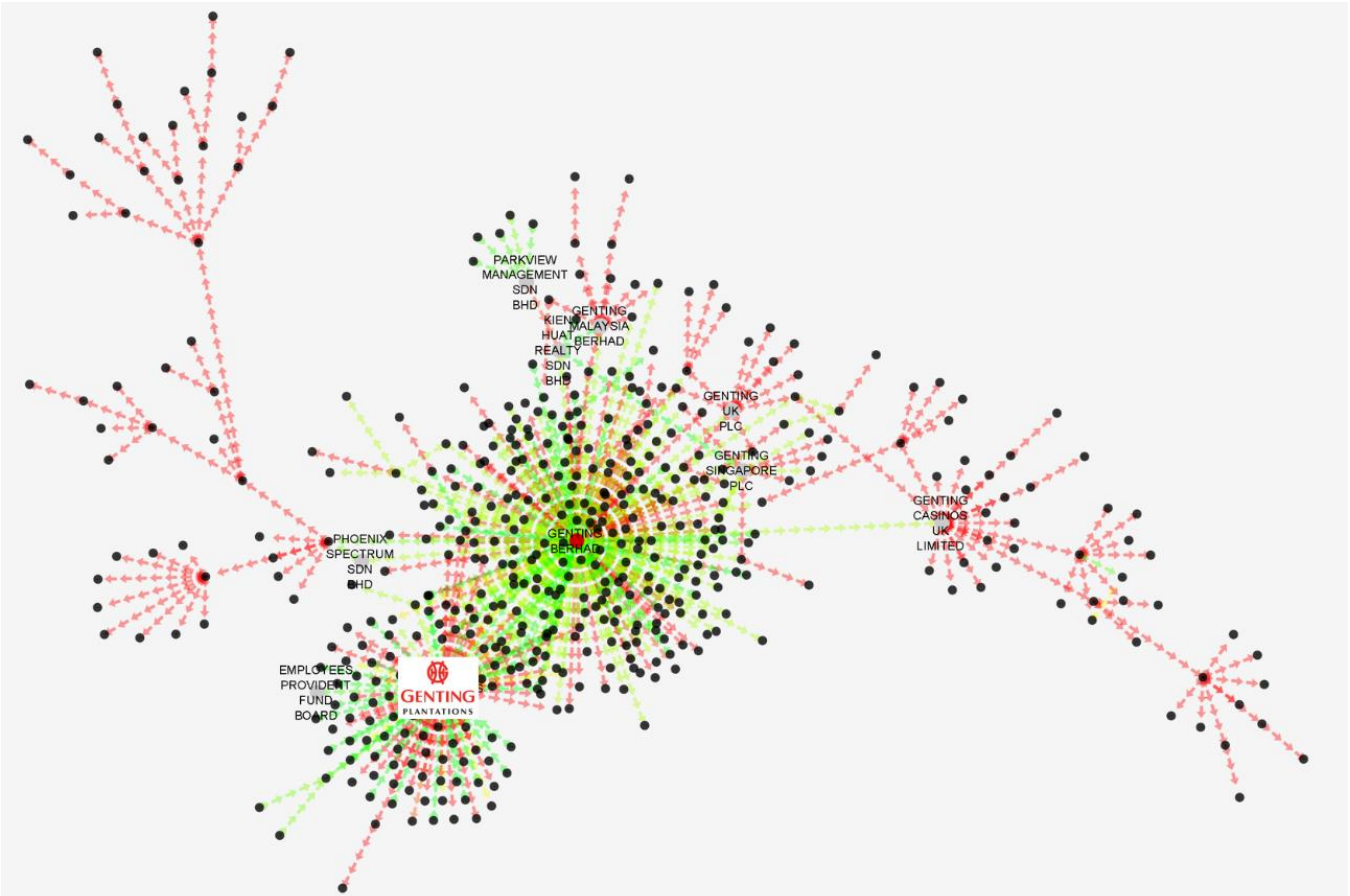

Figure 4.13. Genting Plantations shareholdings ownership topology using prefuse network layout

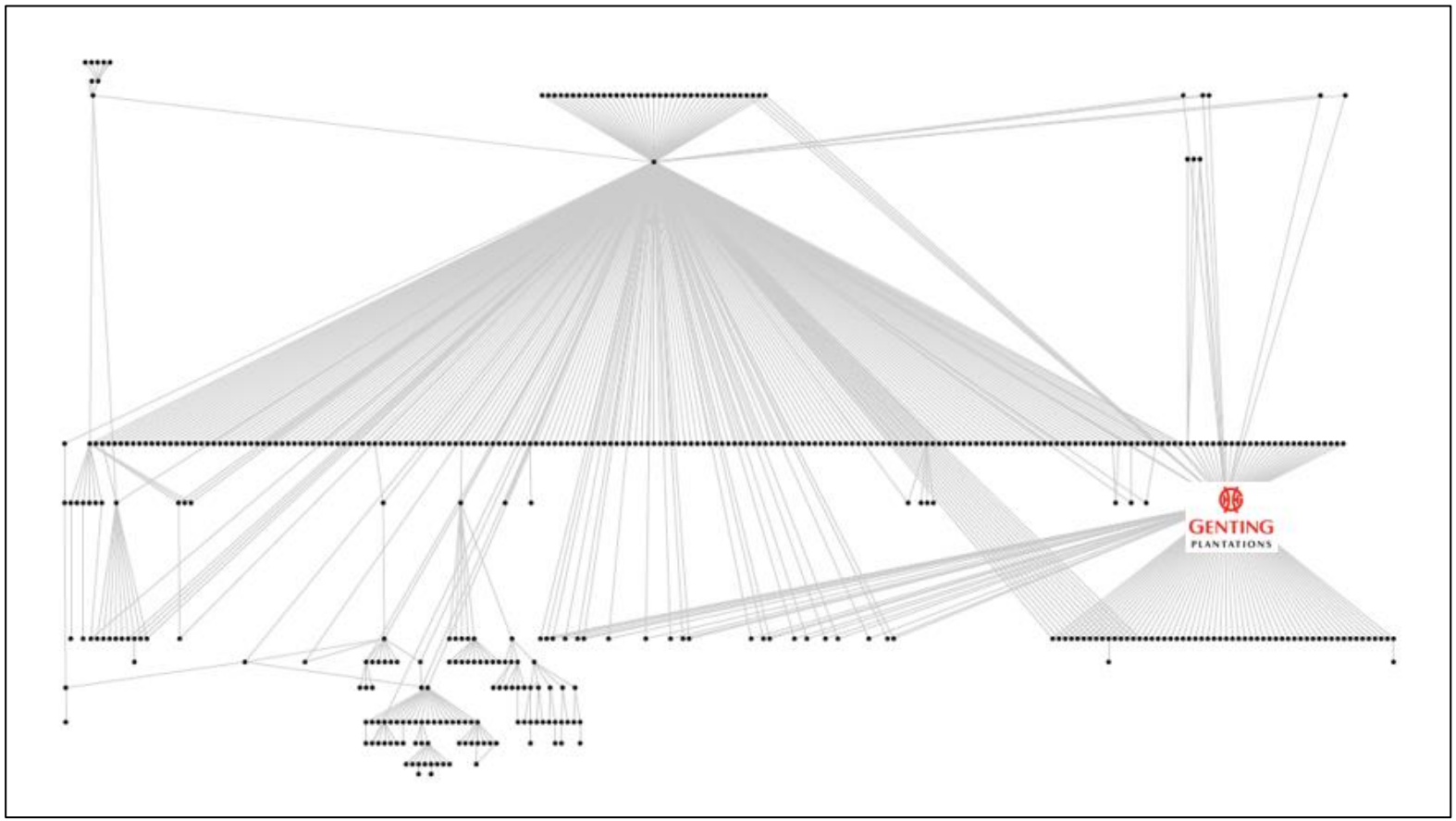

Figure 4.14. Genting Plantations shareholdings ownership using hierarchical layout

Figure 4.13 shows that Genting Plantations is owned by Genting Berhad which is owned by Kien Huat Realty Sdn Bhd which is in turn owned by Parkview Management Sdn Bhd. Lim Goh Tong's family owns Parkview Management. Employees Provident Fund (EPF), a statutory body that acts as a government investment company also has a 16% share in Genting Plantations.

While the oil palm plantation business remains the core activity of Genting Plantations, the Company has diversified into property development to unlock the value of its strategically-located land bank through its wholly-owned subsidiary Genting Property Sdn Bhd.

Genting Berhad's major subsidiaries are Genting Plantations, Genting UK PLC, Genting Singapore PLC, and Genting Casinos UK Limited.

Genting UK PLC operates a network of casinos in England and Scotland. It also operates an online casino and poker room that offers various casino games. Genting UK PLC was formerly known as Genting Stanley PLC and changed its name in March 2009. The company was incorporated in 1980 and is based in Birmingham, United Kingdom.

Genting Singapore Plc was incorporated in 1984 in the Isle of Man. Genting Singapore was converted into a public limited company on 20 March 1987 and listed on the Main Board of the Singapore Exchange Securities Trading Limited on 12 December 2005. For over 30 years, Genting Singapore and its subsidiaries have been at the forefront of gaming and integrated resort development in Australia, the Bahamas, Malaysia, the Philippines, Singapore and the United Kingdom. Today, they are best known for the award-winning flagship project, Resorts World™ Sentosa in Singapore, which is one of the largest fully integrated destination resorts in South East Asia.

Genting Casinos UK Ltd is majority owned by Genting Berhad. Genting UK is one of the leading casino operators in the UK, with its ownership of 41 of the total 143 operating casinos as at 31 December 2013. In London, Genting UK operates a total of six casinos following the reopening of Genting Casino Chinatown in the heart of the City's West End in March 2013. Genting UK's competitive position in the London casino market is strong, led by its great heritage and flagship offerings which capitalise on its four prestigious brands in the capital city. Outside London, Genting UK continued its investment in improving its provincial properties with significant refurbishments having taken place at Stoke, Liverpool, Luton, Salford, Edgbaston, Nottingham and Glasgow. This leads to extensive clusters formation in the network.

Jaya Tiasa Holdings Berhad

Referring to Table 4.8, Jaya Tiasa has five layers in its pyramid, the lowest among the FOBs. It has one level of ownership in another company, among the smallest in FOBs. Its subsidiaries size is 28. This could be due to its sole focus on timber and oil palm plantation related business, apart from its main holding group of Rimbunan Hijau. The shareholder's size is 27, which suggests that the company operates in a small circle of the network but with a large number of shareholders. Jaya Tiasa is 75% hierarchic, the lowest among FOBs. It suggests that the decision-making control is decentralised, where the subsidiaries are autonomous. It has 81 companies visualised in the network.

Table 4.8. Jaya Tiasa network topology metrics

Network metrics/ Company	Network diameter	Average ownership tier	Subsidiary degree	Shareholdings degree	Hierarchical index	No. of nodes
JAYA TIASA	5	1.07	28	33	75%	81

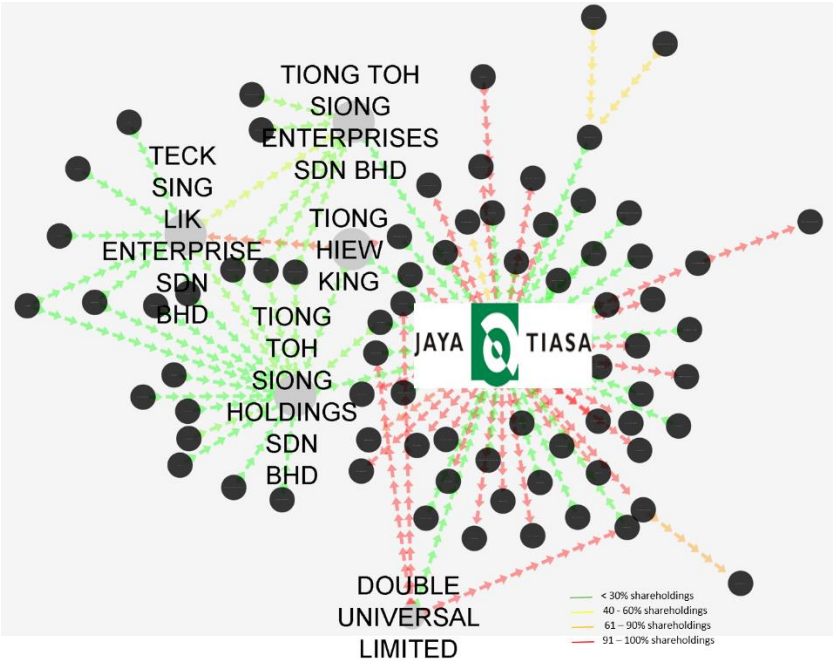

Figure 4.15: Jaya Tiasa shareholdings ownership topology using prefuse network layout

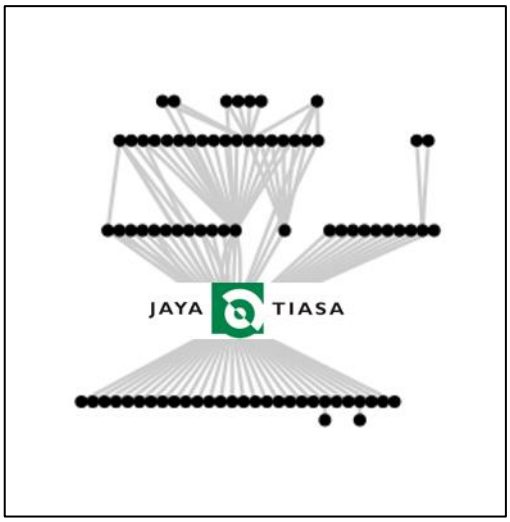

Figure 4.16: Jaya Tiasa shareholdings ownership using hierarchical layout

In Figure 4.15, the links to the major shareholders are clear. The company is majority-owned by Tiong Toh Siong Holdings with 22%. The other two major shareholders are Genine Chain Limited with 18% and Double Universal Limited with 15% through Amanas Sdn Bhd, Nustinas Sdn Bhd, and Insan Anggun Sdn Bhd. Genine Chain Limited and Double Universal Limited were incorporated in 1992 as private company limited by shares registered in Hong Kong.

4.2 GLCs AND FOBs SHARE OWNERSHIP STRUCTURE

Comparison of the GLCs network topology metrics is shown in Table 4.9. Results in the table reflect in some ways the results in Figures 4.17 and 4.18. Referring to Figure 4.17, Sime Darby is the biggest group among all GLCs in the network, followed by Boustead, and IJM. But, the network diameter in Table 4.9 shows Boustead has the largest pyramid tiers. Although Sime Darby is big, but it's not reflected in its pyramidal tiers. IJM Plantations is not as big as Sime Darby in Figure 4.17, but results in Table 4.9 shows a similarity in terms of pyramidal tiers. The size of the subsidiaries degree defines the size of Sime Darby as shown in Figure 4.17. Given the smallest average ownership tier and largest subsidiaries degree among all GLCs, Sime Darby's structure can be seen as very centralised. The highly centralised structure indicates the decision-making load may be heavy at the top of the pyramid.

It is clear that, within GLCs, there are variations of share ownership structure. Kulim has the lowest value for all of the network metrics. It reflects its size of business operation. This may be due to its ownership through the state-owned investment company, compared to Sime Darby, Boustead, and IJM Plantations which are owned by the federal GLICs. The amount of investment for the federal

GLICs is more than the state GLIC. In terms of decision-making process, the state-owned investment company has a shorter process, as indicated by Kulim's pyramidal tier and hierarchical index.

The GLCs are linked via GLICs, such as PNB, EPF, LTAT, and Kumpula Wang Persaraan (KWAP). The GLICs have a stake in the four plantation companies. However, the percentage of their shares are small, except for PNB and LTAT. The small percentage of shareholdings suggests that its motive is to focus on the return on investment, instead of controlling the business's decision-making. PNB is the major shareholder for Sime Darby and IJM Plantation, which are the big players in oil palm plantation.

The links via GLICs show the agribusiness corporations are heavily financialised by the financial institutions. This could shift their strategies in the decision-making for sustainable development.

Figure 4.18 shows the ownership structure in a hierarchic layout for all four GLCs. Boustead and Sime Darby stand at the second and third level from the top of the hierarchy. IJM Plantations and Kulim are situated at the fifth level of the hierarchy. This indicates that Sime Darby and Boustead are higher than Kulim and IJM Plantations in the GLCs' hierarchical structure. It also shows their differences in terms of business scales even though all of them are owned by the government. Given the advantage of big businesses, Sime Darby and Boustead are leading the GLCs in the plantation sector. Their decisions have significant impacts on the industry as well as to the other firms in the sector. Sime Darby and Boustead share a similar hierarchical index, but their average ownership tier is different. It proves that, although the organisation is hierarchical, the design of the ownership structure plays an important role too. Li and Wu (2010) agreed that ownership structure determines performance and future growth of the company. The structure plays the role as a corporate governance mechanism. Thus, the size of the corporation and composition of shareholdings are important for achieving good corporate governance.

Table 4.9: GLCs network topology metrics

Type of ownership	**GLC**			
Network metrics/Company	**SIME**	**BOUSTEAD**	**IJM**	**KULIM**
Network diameter	9	11	8	4
Average ownership tier	1.44	4.00	2.41	1.96
Subsidiaries degree	499	93	79	20
Shareholdings degree	29	44	33	27
Hierarchical index	92%	94%	84%	81%
Number of nodes	736	1350	421	101

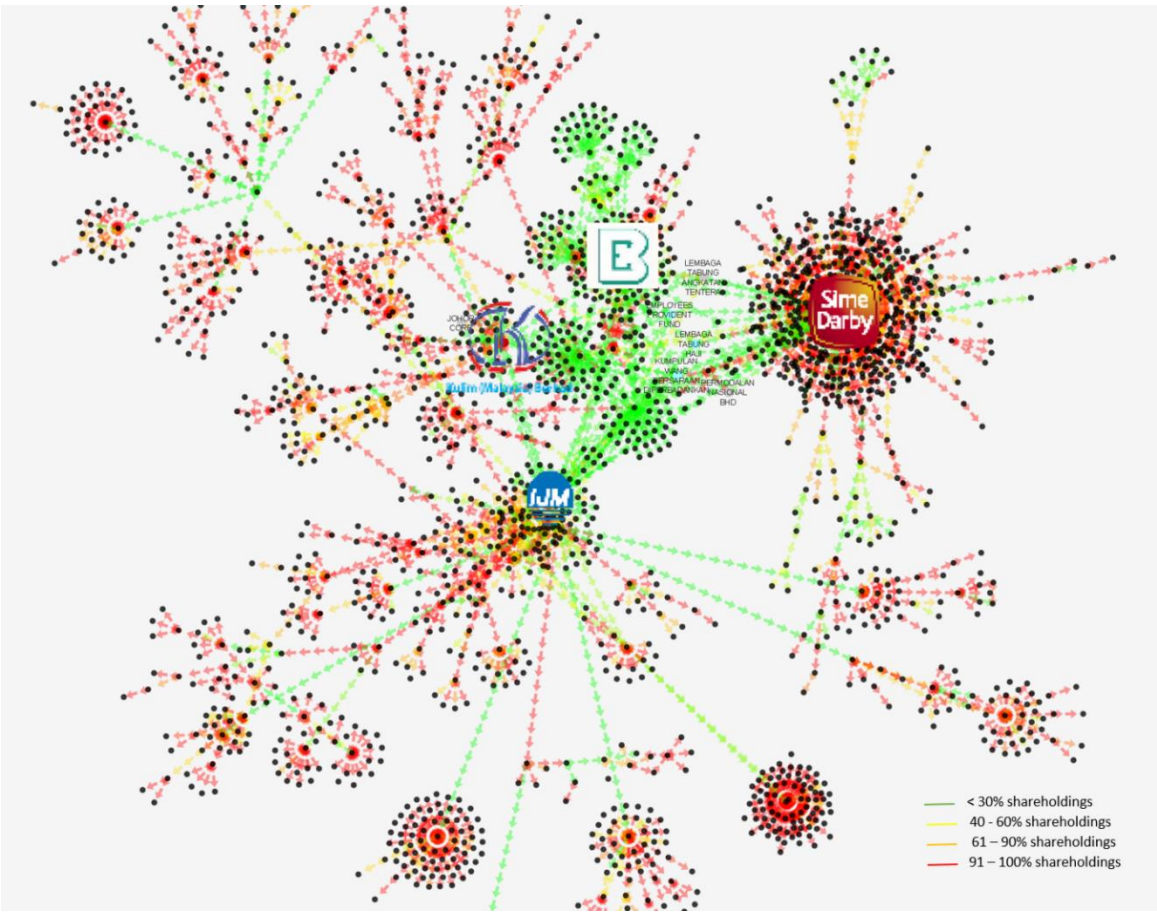

Figure 4.17. Government-linked companies (GLCs) shareholdings ownership topology using prefuse network layout

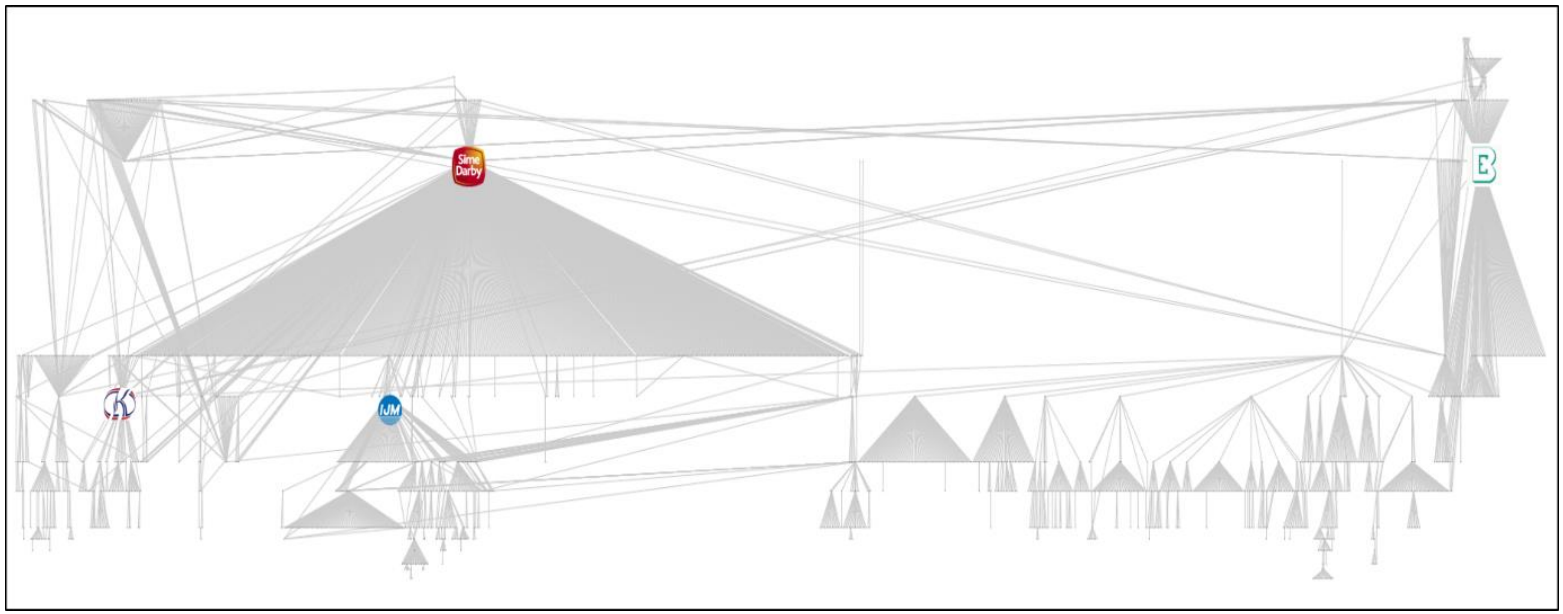

Figure 4.18. Government-linked companies (GLCs) shareholdings ownership structure using hierarchical layout

Table 4.10 compares the network topology metrics among family-owned businesses. KLK has the highest pyramidal tiers among all FOBs. This could be due to its owner, Batu Kawan – a significant corporate entity in the plantations sector – beinghighly involved in KLK's business operations, thus contributing to the pyramid tiers. However, the hierarchical index is smaller than IOI and Genting Plantations. IOI Corporations and KLK are very much similar except for the hierarchy index. Genting Plantations and Jaya Tiasa has a similarity in terms of the average ownership tier. Jaya Tiasa has the lowest value for all its network metrics. It shows the scale of its business operations, as it has the least land bank area compared to the other FOBs.

Figure 4.19 demonstrates the ownership structure for the family-owned plantation companies. The companies' sizes are similar except for Jaya Tiasa, the smallest among them. Although they are owned by different families, they are linked to similar financial investment institutions, such as PNB, Dimensional Fund Advisors, Public Bank, Eaton Vance Corp, and others. The shareholdings percentage of these financial investment institutions are small and suggests less control than the family owner. However, it indicates that the family-owned businesses are going through similar financialisation as the government-owned businesses.

The family-owned structure topology is relatively smaller than the government-owned topology. This is due to the size of companies and the fact that family-owned firms are smaller than government-owned firms. Although the business activities are similar for both family-owned and government-owned, family-owned companies are less hierarchical.

Figure 4.20 illustrates the hierarchical structure of the family-owned companies. IOI Corp, KLK, and Jaya Tiasa are at the same level in the hierarchy. Since Genting Plantations is owned by Genting Berhad, it is situated at one level lower in the hierarchy. Based on the figure, it is clear that the family-owned companies have cross-shareholdings at the top level of the hierarchy. This is not the case in the previous Figure 4.18 for the GLCs.

Table 4.10: FOBs network topology metrics

Type of ownership	Family-owned			
Network metrics/Company	**KLK**	**IOI**	**GENTING**	**JAYA TIASA**
Network diameter	12	11	9	5
Average ownership tier	3.06	3.32	1.03	1.07
Subsidiaries degree	116	74	77	28
Shareholdings degree	43	36	41	33
Hierarchical index	81%	93%	90%	75%
Number of nodes	520	639	483	81

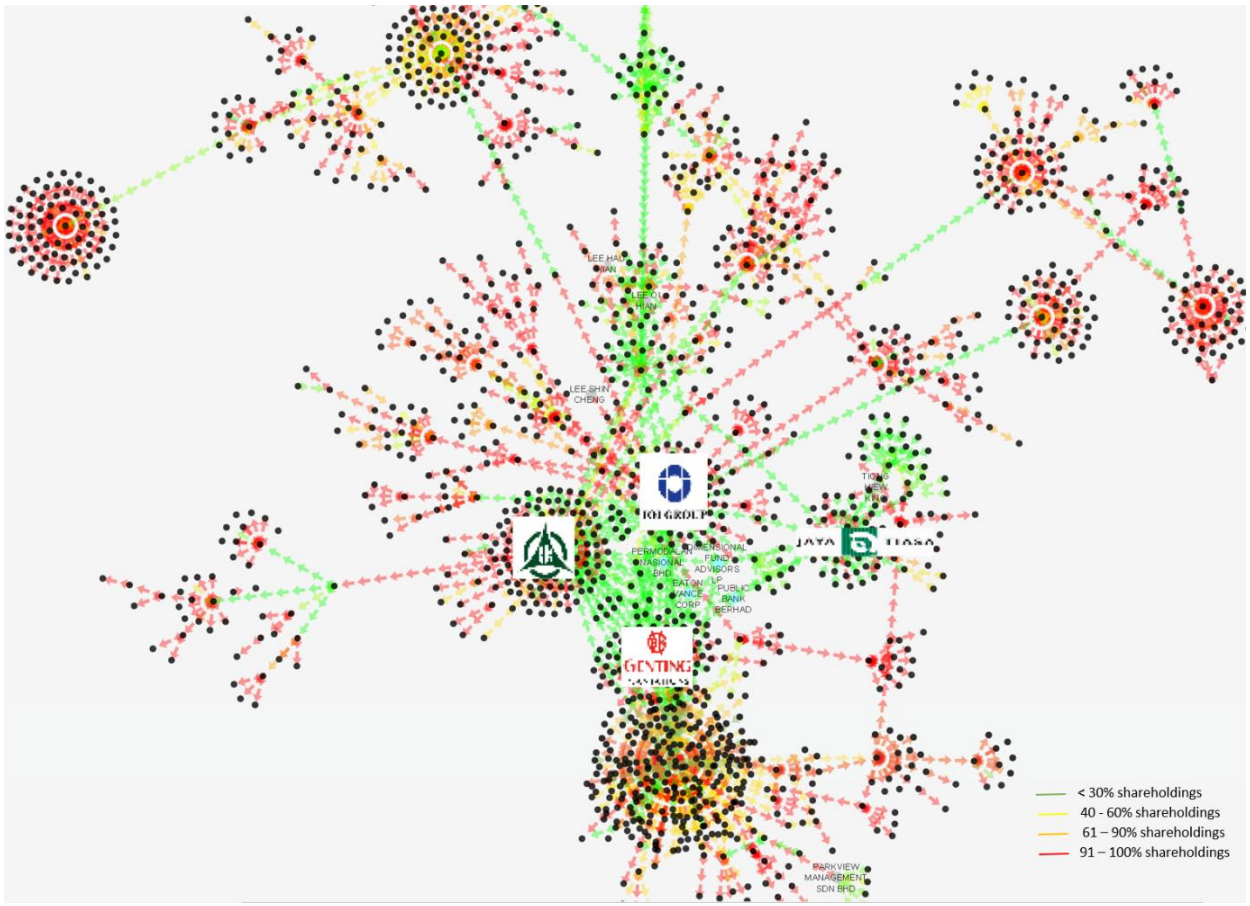

Figure 4.19. Family-owned companies shareholdings ownership structure using prefuse network layout

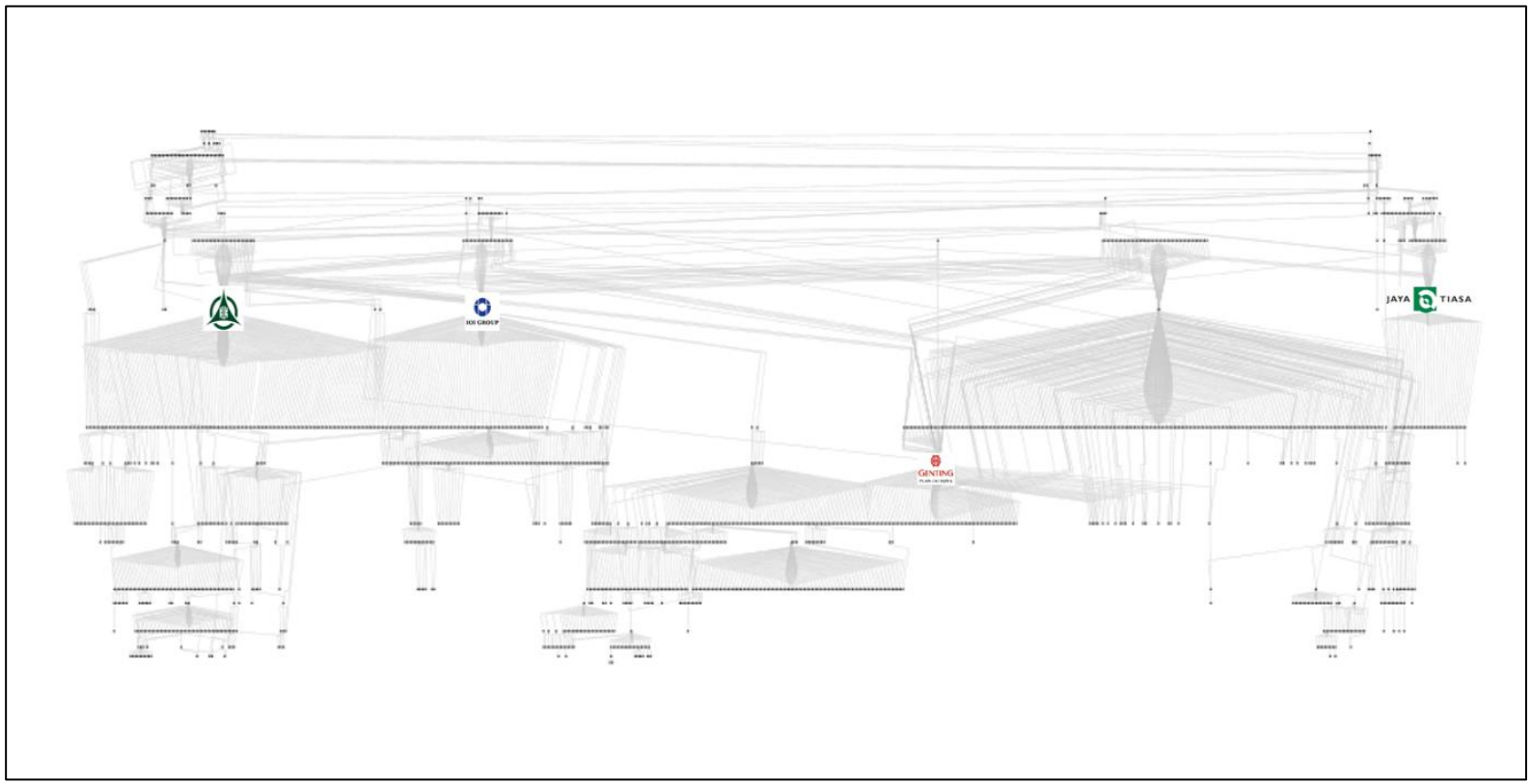

Figure 4.20. Family-owned companies shareholdings ownership structure using hierarchical layout

4.3 Agribusiness and Plantation Sector Share Ownership Structure

Table 4.11 concludes the features of both GLCs and FOBs in agribusiness and the plantation sector. The largest pyramid structure belongs to KLK, followed by IOI Corp and Boustead. Both KLK and IOI Corp are FOBs, whilst Boustead is a GLC. Kulim, a GLC and Jaya Tiasa, an FOB, have the smallest pyramid structure. The largest ownership tier is with Boustead (GLC) followed by IOI Corp (FOB) whilst Genting Plantations and Jaya Tiasa have the smallest ownership tier among all companies.

Sime Darby has the biggest subsidiaries size, followed by Boustead. The smallest subsidiaries size on the other hand, is seen with Kulim. Kulim has the smallest number of shareholders. Boustead has the largest shareholders, followed by KLK. The most hierarchical company amongst the GLCs and FOBs in the plantation sector is Boustead, followed by IOI Corp. The least hierarchical business group is Jaya Tiasa. Boustead also has the most number of companies in the structure presented in this research, followed by Sime Darby.

Based on these findings, it can be concluded that the ownership identity (GLC or FOB) did not shape the company's structure topology, at least in the plantation sector in Malaysia. Both GLCs and FOBs have their own characteristics in forming their corporate structure. This can be derived from its history of establishments and series of transformations as a result of political histories and economic development (Roe, 1993).

Table 4.11: Network topology metrics for major plantations companies

	GLC				Family-owned			
Network metrics/Company	**BOUS**	**SIME**	**IJM**	**KULIM**	**GENT**	**IOI**	**KLK**	**JT**
Network diameter	11	9	8	4	9	11	12	5
Average ownership tier	4.00	1.44	2.41	1.96	1.03	3.32	3.06	1.07
Subsidiaries degree	93	499	79	20	77	74	116	28
Shareholdings degree	44	29	33	27	41	36	43	33
Hierarchical index	94%	92%	84%	81%	90%	93%	81%	75%
Number of nodes	1350	736	421	101	483	639	520	81

Shareholdings ownership topology for the eight major plantation companies is shown in Figure 4.21. Even though they are owned through different patterns of owners, all of them are linked and connected to each other to a certain degree. Four of the companies, IOI Corp, KL Kepong, Genting Plantations, and IJM Plantations are close to each other at the core of the network. Sime Darby and Boustead are at the periphery of the network. Jaya Tiasa and Kulim are at the circumference of the core. The shareholdings at the network core are mostly at a minimal percentage, except for the major shareholders for GLCs.

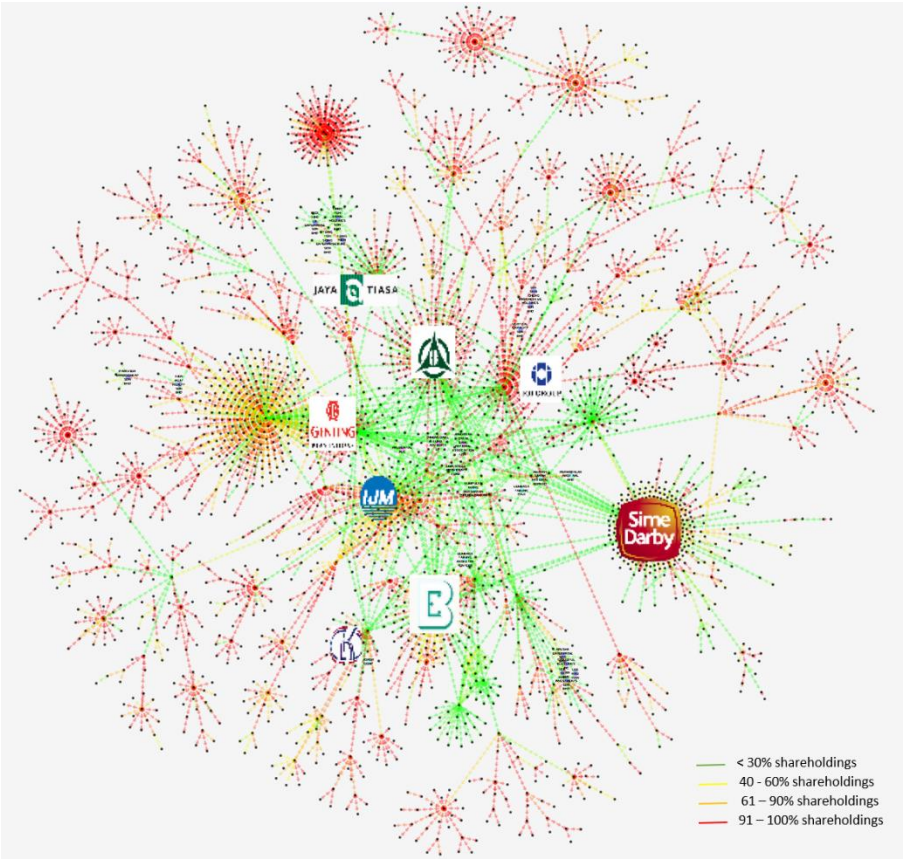

Figure 4.21. Shareholdings ownership topology for palm oil GLCs and family-owned corporations using prefuse network layout

The zoomed-in figure (Figure 4.22) is to illustrate the centre of the topology and the links that link all the eight corporations. There are three types of shareholders in the figure below. The blue nodes indicate GLICs; the pink nodes indicate private financial investment institutions and the purple nodes are the family-owned firms.

The shareholdings topology are similar for both GLCs and family-owned businesses. They are all financialised by financial investment institutions. However, the degree of the financialisation differs from each other. GLCs' major shareholders are linked to most of the other companies, including the family-owned firms. In contrast to that, the family-owned firms' major shareholders are not linked to any other companies. GLCs' shareholders are mainly the investment houses which focus on building the nation's wealth. They have the ability and the capacity to invest widely in other companies to maximise their returns. On the other hand, family-owned firms' shareholders are mainly independent investing institutions, which have limitations in investing at a bigger scale. They tend to focus on creating and circulating their wealth internally within their holdings group.

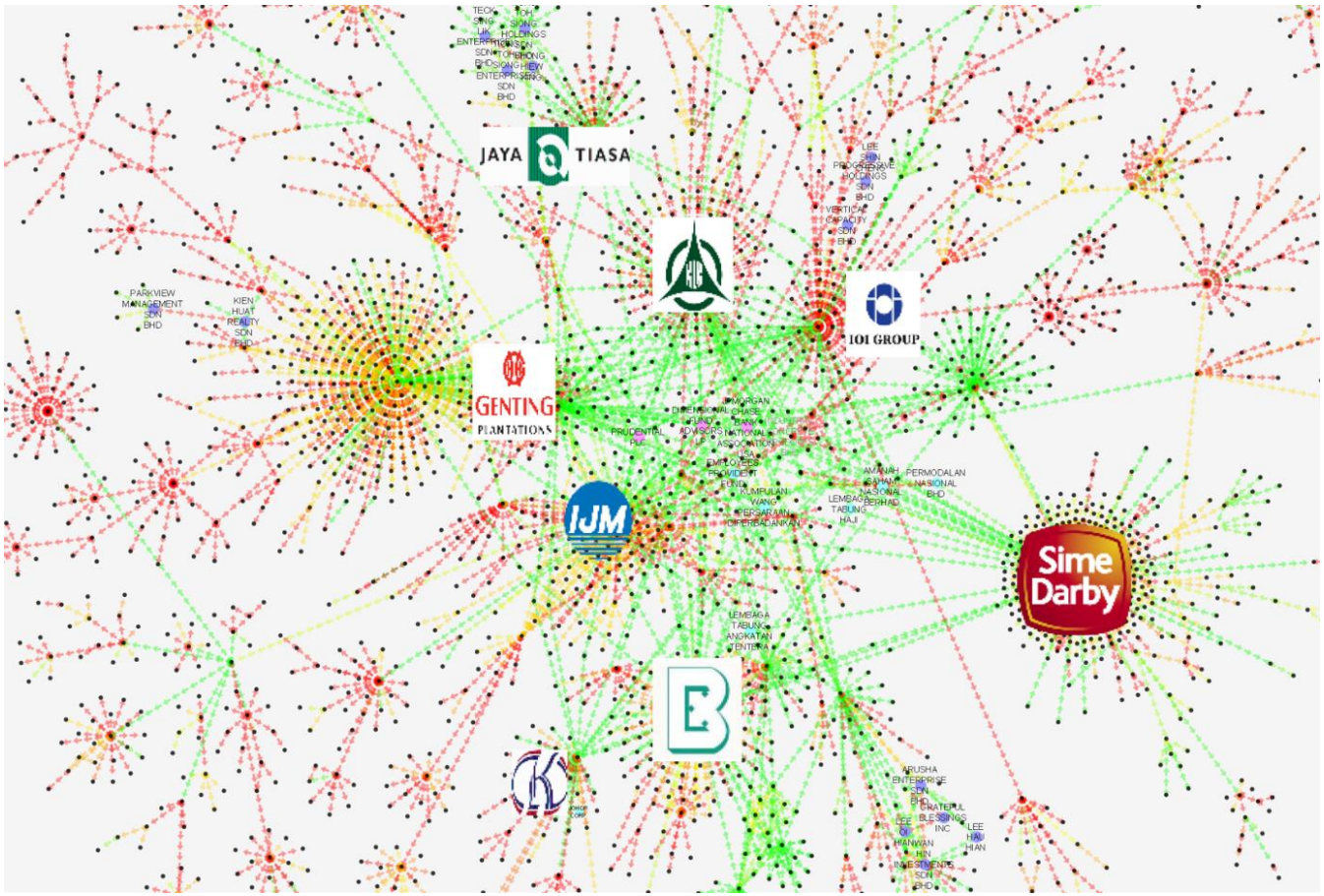

Figure 4.22. Zoomed-in of the shareholdings ownership topology for palm oil GLCs and FOBs

Figure 4.23 shows the hierarchical layout of the major oil palm companies. There five companies: Sime Darby, Boustead, IOI Corp, KLK and Jaya Tiasa situated at the fourth level of the hierarchy. Three other companies, IJM Plantations, Kulim, and Genting Plantations are at the mid-level of the hierarchy. This could be due to their main holdings company as the major shareholders. There are many cross-linkages among the top level in the hierarchy involving family-owned companies. It is evident that there are various proportions of the hierarchical structure for all companies. These variations lead to their decision-making behaviours. This will be uncovered and discussed in the next chapter.

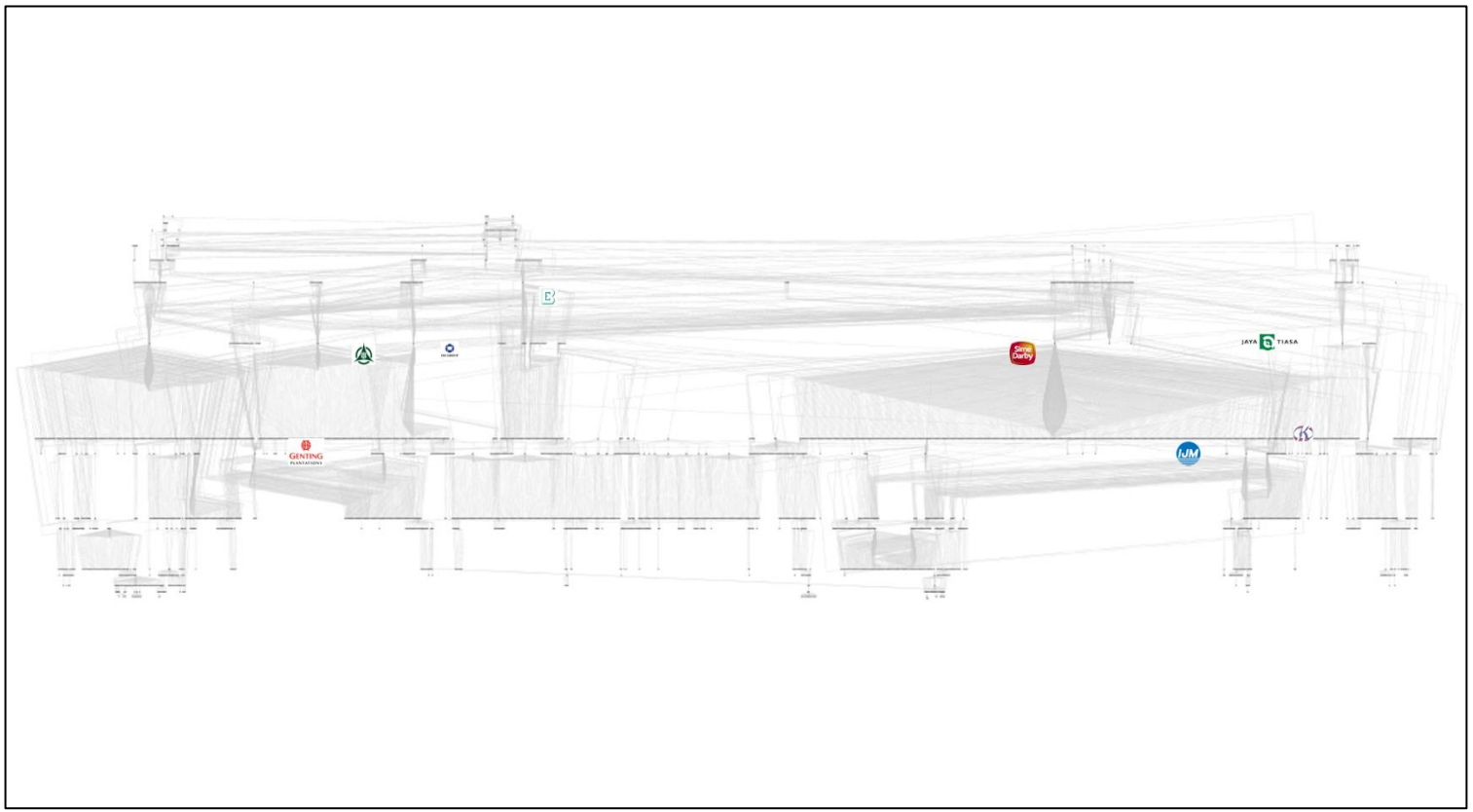

Figure 4.23: Ownership hierarchy structure of the major oil palm plantations companies

CHAPTER 5

STRUCTURAL CONTROL AGAINST DECISIONS LOAD

This research further analyses the shareholdings data to develop an advanced understanding of the corporations' control of decision-making. With the help of network analysis, the shareholdings data produced fascinating results that lifts the understanding of the business groups' ownership and control structure to a new level. The advanced network centralities are the core feature of network analysis, and the results are presented in this chapter.

In chapter three, two core centralities metrics were highlighted, betweenness and stress. Betweenness indicates the structural control and stress indicates the decisions' load. These metrics provide the insights to compare the control and the load of decision-making between the eight companies. The comparison is to analyse how the company's ownership structure influences their decision-making behaviour. The analysis qualified the company's structure and gives deeper insights in understanding their decision-making behaviour individually and as a group – GLC and FOB.

At the end of this chapter, the findings shows the model that explains the government-owned and family-owned company's ownership structure and decision-making control in the plantation sector. This model can be replicated to another scope of study and to a different dataset to test its suitability and diversity.

5.1 Network Centralities Metrics

5.1.1 Structural Control

Network analysis produced betweenness centrality metric for the eight companies. The study compared their means using a t-test. The test determines whether there is a statistical significant difference between the means in the separate GLC and FOB groups. In terms of this research, the t-test is to see whether the structural control of the eight companies is different or similar to each other.

Table 5.1: Structural control t-test mean values comparison

Structural control (p value)			Structural control (p-value)							
			GLC				Family-owned			
			Boustead	Sime Darby	IJM	Kulim	IOI Corp	KLK	Genting	Jaya Tiasa
	GLC	Boustead	1.000							
		Sime Darby	0.587	1.000						
		IJM	0.000*	0.000*	1.000					
		Kulim	0.000*	0.000*	0.002*	1.000				
	Family-owned	IOI Corp	0.000*	0.434	0.000*	0.000*	1.000			
		KLK	0.027*	0.222	0.000*	0.000*	0.560	1.000		
		Genting	0.000*	0.013*	0.005*	0.000*	0.428	0.252	1.000	
		Jaya Tiasa	0.000*	0.000*	0.017*	0.665	0.020*	0.000*	0.000*	1.000

*Note: * p-value significant at 0.005.*

The mean value comparison of structural control shows some significant patterns based on the p-value produced from the t-test (see Table 5.1). The results show the GLCs' and FOBs' structural control have similarities as well as differences. Between GLCs and FOBs, a mixed pattern has appeared. Not all GLCs' structural control are significantly different from FOBs. Within the GLCs, the structural control for Boustead and Sime Darby were significantly different than IJM and Kulim. Kulim's structural control was similar to Jaya Tiasa, but not the other GLCs. Boustead and Sime Darby have a similar structural control. For example, Sime Darby's structural control is similar to IOI Corp and KLK; both are FOBs and Boustead, a GLC. The internal control in the company's structure is similar for Sime Darby, IOI Corp, KLK, and Boustead. The control of the decision-making within the same tier in the company's hierarchy is similar for these companies.

The similarity between Sime Darby and Boustead could be due to the similar history of the establishment; both were initially a foreign-owned company and have close links with their major shareholders, PNB and LTAT, the major and influential GLICs respectively. Additionally, the structural control is similar for companies that have similar sizes in the similar sector; regardless whether they are government-owned or family-owned.

Based on the result in Table 5.1, IJM Plantations' structural control was significantly different with the other GLCs and all FOBs. IJM Corp, the main holding company is a federal government-linked company which was formed through a joint venture with a local firm. There is every likelihood that the main group has high control over the subsidiaries decision-making process. Unlike the other GLCs, IJM Corp is the only federal state-owned company (among Sime Darby, Boustead, and Kulim) which initially was not a GLC. The control through the hierarchy structure is potentially embedded in the history of a company's establishment.
Kulim's structural control is significantly different from other GLCs too. Being the only state-government owned company in this research could be the reason explaining the difference. Apart from who owns the companies, the federal government or the state government, the design of the ownership structure is crucial. The management team and the monitoring board of directors play an important role in complementing the effectiveness of the corporate structure design.

As for the FOBs, a mixed pattern has appeared. Within the family-owned companies group, their structural controls have some similarities and differences. KLK's, IOI Corp's, and Genting Plantations' structural control are similar. They are well established and well known family-owned conglomerates. KLK and Genting are led by the second generation of the founder's family. KLK and IOI Corporation are involved in similar businesses that justify their similarity in structural control. Jaya Tiasa's structural control is different from the other family-owned companies. Based on this analysis, their shareholdings structure is different from the other family-owned companies. Their shareholdings are not as dispersed as the other family-owned companies. Jaya Tiasa's structural

control is similar to a state-government linked company, Kulim. Kulim also has a concentrated shareholdings structure.

Each company has its ownership structure design prior to their establishment history. Structural control is rooted in the hierarchy as they grow and become embedded in the ownership structure design. This could be the reason for their commonalities and differences.

5.1.2 Decision's load

We compare the mean values of decisions' load; it showed no distinct pattern. Most of the means were not significantly different from each other. For GLCs, Boustead's, Sime Darby's and IJM Plantations' decisions load appear more significantly different than a few other companies. For example, Boustead is significantly different with all companies except IJM Plantations. Sime Darby is significantly different to Boustead and IJM Plantations but similar with all other companies.

This suggests that within Boustead's and IJM Plantations' hierarchy structure, the amount of decisions that is fed to the structure are similar. Within the GLCs, Boustead's decisions load in the structure is different than Sime Darby and Kulim. The difference between Boustead and Kulim could be justified by their different company's size. Sime Darby's management is run by professionals who have experience in their respective business activities, however, this is not the case for Boustead. Boustead's management team are not all professionals in their respective business division. Having professionals as the decision maker could lead to differences in the decisions load within the structure.

Within FOBs, all of the companies showed a similar decisions load in their structure. Boustead is the only GLC that has a different decisions' load with the FOBs. It showed that among the family-owned companies, their decisions' load is similar although their corporate structures are different. Some of the GLCs have different decisions' load than the others. This suggests that the GLCs and FOBs decisions load could not significantly be explained by their shareholdings structure.

Table 5.2: Decisions load t-test mean values comparison

Decisions load (p value)			Decisions load (p value)							
			GLC				Family-owned			
			Boustead	**Sime Darby**	**IJM**	**Kulim**	**IOI Corp**	**KLK**	**Genting**	**Jaya Tiasa**
	GLC	**Boustead**	1.000							
		Sime Darby	0.000*	1.000						
		IJM	0.412	0.025*	1.000					
		Kulim	0.013*	0.694	0.069	1.000				
	Family-owned	**IOI Corp**	0.000*	0.473	0.066	0.405	1.000			
		KLK	0.000*	0.327	0.003*	0.796	0.072	1.000		
		Genting	0.004*	0.613	0.125	0.515	0.938	0.176	1.000	
		Jaya Tiasa	0.010*	0.482	0.052	0.718	0.271	0.949	0.379	1.000

*Note: * p-value significant at 0.005*.

Comparison of the decisions load seems to be of little help to understanding the decision-making behaviour among these corporations. This research regressed structural control and decisions load to provide a holistic insight in deciphering GLCs and FOBs decision-making behaviour.

5.1.3 Structural Control Against Decisions Load

This research visualises both metrics in a network visual. Figure 5.1 illustrates the bigger picture of structural control against decisions load for the eight agribusiness companies involved in this research.

The nodes represent a company in the eight companies' shareholdings structure. The node's size signify the amount of structural control. The bigger the nodes, the higher the structural control. The nodes' colour, red to green shades show high to low range of decisions load, red colour nodes have the highest decisions load, and green colour nodes indicate low decisions load.

Boustead and Affin Holdings have the highest structural control and decisions load (Table 5.3). This is due to their extensive shareholdings in other companies because Affin Holdings is the financial investment institution, and the shareholdings are across the entire economic sector. IJM Corporation has higher structural control and decisions load because it has extensive shareholdings due to its diversified business activities.

Boustead and Affin, IJM Corporation and IJM Plantations, and Genting Berhad and Genting Plantations are in the same business groups respectively. Boustead Holdings, IJM Corporations and Genting Berhad are the main holding companies in each group, whereas Affin Holdings, IJM Plantations and Genting Plantations are the major subsidiaries of the respective main holding company. The metrics for decisions load of the top three companies (Boustead, Affin and IJM Corporation) in Table 5.3 shows a big gap with the bottom seven companies. Decisions load is calculated based on the number of the shortest path across each company's network respectively; it shows that these three companies have a higher number of shortest paths than the others. The higher number of shortest paths indicates that the company has a higher number of links in connecting them to the neighbours. Boustead and Affin has the most heavy decisions load among the major plantation companies. This could be related to its extensive shareholdings in the financial institutions. Since the shareholding represents the links between companies, it translates into the decisions load via the shareholding links.

Table 5.3: Structural control and decisions load index for major oil palm plantations companies

Ranking (highest to lowest decisions load)	Company	Decisions load index	Structural control index
1	Boustead	126842	0.0093
2	Affin Holdings	119966	0.0088
3	Kuala Lumpur Kepong	60711	0.0045
4	IJM Corporation	51508	0.0032
7	IJM Plantations	42365	0.003
8	IOI Corporations	32523	0.0025
12	Sime Darby	24243	0.0018
13	Genting Berhad	19693	0.0018
21	Kulim Malaysia	8968	7.65 E-4
85	Jaya Tiasa	1710	1.4 E-4

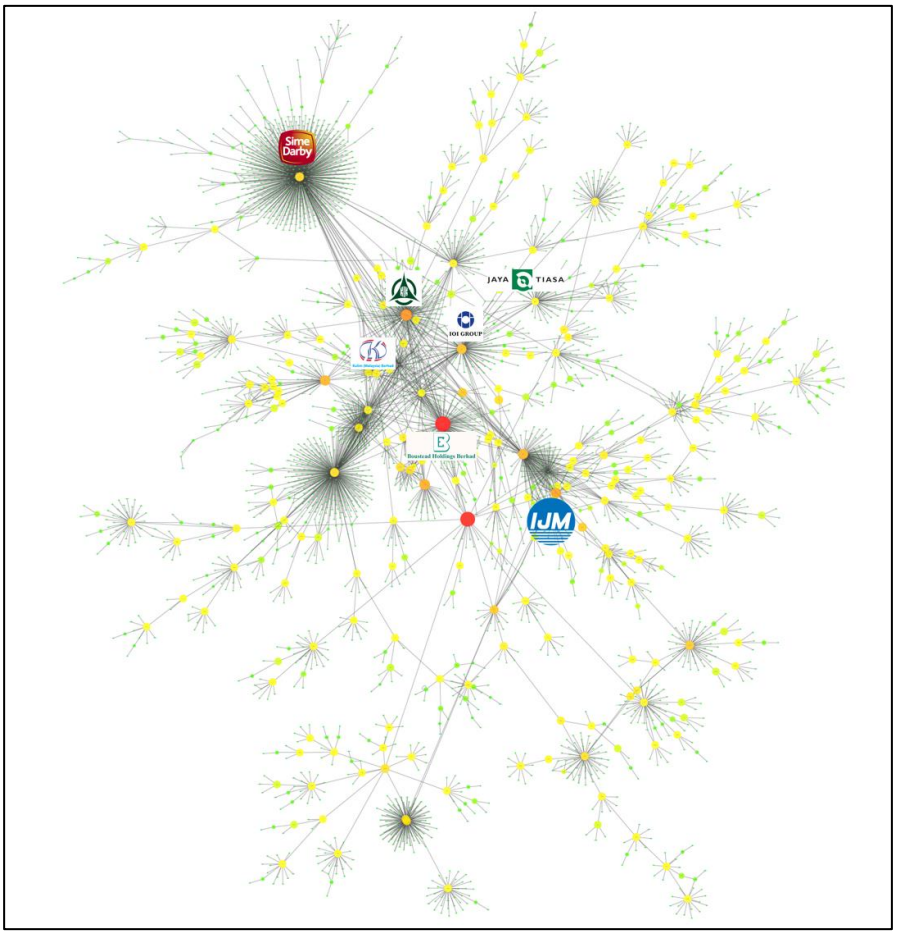

Figure 5.1: Structural control and decisions load for major oil palm plantations

5.2 Identifying Model

The structural control and decisions load indexes were then converted to log values to improve the statistical interpretability. Based on the result, we run a simple linear regression to investigate the type of relationship that structural control and decisions load have.

5.2.1 Local Model

The study ran a simple linear regression using the following model:

Structural control (C) = function of structural load (S) (5.1)

As this is classified as the local model, there are eight individual models for each corporation which can also be written as:

$$C^{corp}=f(S_i^{corp}, a^{corp}, b^{corp}) \qquad (5.2)$$

$$C^{corp} = a + b\,(S_i^{corp}) \qquad (5.3)$$

where,

C_i^{corp} = Structural control of an agribusiness corporation
a^{corp} = slope for agribusiness corporation
b^{corp} = intercept for agribusiness corporation
S_i^{corp} = Structural load of an agribusiness corporation
i = a subsidiary/shareholdings unit

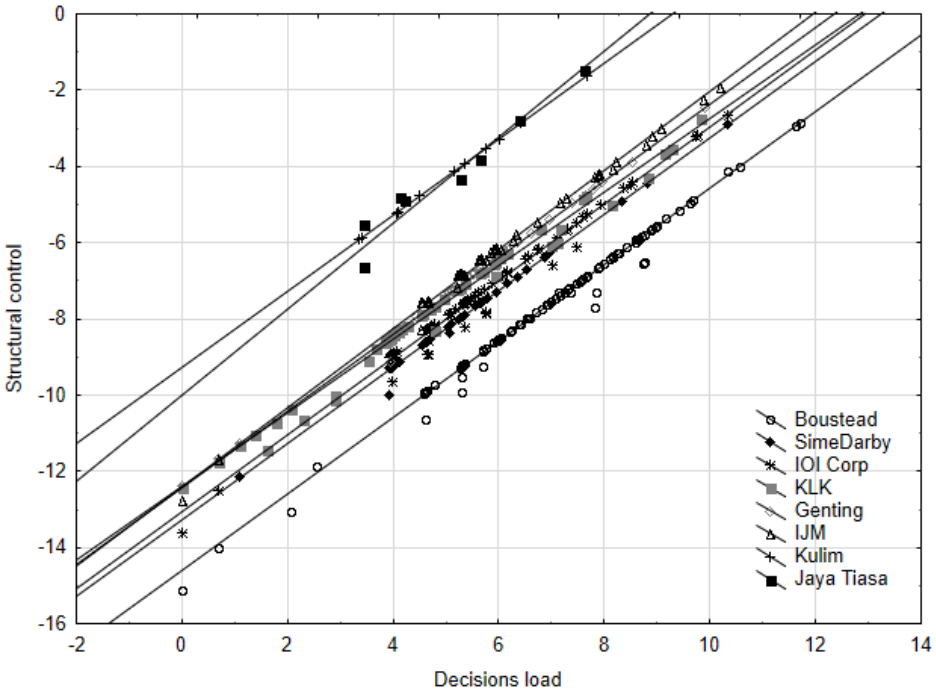

Figure 5.2: Decision-making behaviour for major palm oil corporations using a local model

This model was fit into each corporation's dataset. This model is a local model with eight separate values of *a* (slope) and *b* (intercept) for each palm oil corporation. We regard *a* and *b* as "local parameters". Based on this model, the slopes were compared to check for further similarities and differences.

Table 5.4: Regression results for the corporations (local model)

	Intercept	SE Intercept	Slope	SE Slope	df	N	SD Intercept	SD Slope	r^2
Boustead	-14.587	0.040	1.003	0.006	197	199	0.568	0.090	0.992
Sime Darby	-13.273	0.039	1.004	0.008	55	57	0.296	0.057	0.997
IOI	-13.049	0.073	1.008	0.013	92	94	0.703	0.127	0.985
KLK	-12.407	0.063	0.967	0.012	66	68	0.517	0.010	0.990
Genting	-12.433	0.053	1.006	0.010	49	51	0.378	0.071	0.995
IJM	-12.407	0.060	1.039	0.010	48	50	0.422	0.069	0.996
Kulim	-9.280	0.000	1.000	0.000	12	14	0	0	1
Jaya Tiasa	-9.994	0.480	1.127	0.099	9	11	1.591	0.329	0.935

Table 5.4 shows the regression results using a local model. The fitness of the model ranges from 93.5% (Jaya Tiasa) to 100% (Kulim), which means the model is good in explaining each corporation's structural control against the decisions load. It could be a good proxy to estimate the company's decision-making behaviour. With slope values ranging from 0.97 to 1.13, it is suggested that the regression lines are parallel.

Table 5.5: Slopes comparison for agribusiness corporations' regression lines

Slope (p-value)									
Slope (p-value)		**Boustead**	**Sime Darby**	**IOI Corp**	**KLK**	**Genting**	**IJM**	**Kulim**	**Jaya Tiasa**
	Boustead	1.000							
	Sime Darby	0.903	1.000						
	IOI Corp	0.741	0.005*	1.000					
	KLK	0.001*	0.010*	0.023*	1.000				
	Genting	0.794	0.880	0.918	0.014*	1.000			
	IJM	0.002*	0.006*	0.058	0.000*	0.020*	1.000		
	Kulim	0.650	0.589	0.556	0.008*	0.008*	0.000*	1.000	
	Jaya Tiasa	0.215	0.222	0.237	0.114	0.231	0.382	0.214	1.000

Based on the regression results in Table 5.4, the slopes are compared. Referring to Table 5.5, a comparison of the slopes shows no clear pattern. There is no discernible pattern to provide further information on the decision-making behaviour according to the slopes.

From the local model results, it is found that most of the slope values are close to 1 (Table 5.4). It indicates that all companies potentially have one similar behaviour. To confirm this, we compare a set of the previous regression model (local model) to a regression with all slopes at the value of 1 (global model).

5.2.2 Global Model

Based on the results of the local model, a simple linear regression for the global model was run. A global model means there is one model to represent the decision-making behaviour through structural control and decisions load relationship for all corporations. To provide a unifying theory, it was decided to have only one value of the slope, *a,* for all corporations and having eight values of intercepts, *b*. The global model is as follows:

$$C_i^{corp} = f(S_i^{corp}, a \text{ global}, b \text{ local}) \qquad (5.4)$$

where,

C_i^{corp} = structural control of agribusiness corporations
a = slope of the eight agribusiness corporation
b^{corp} = intercept of an agribusiness corporation
S_i^{corp} = structural load of agribusiness corporations
i = a subsidiary/shareholdings unit

This research employs the global model because it can represent all corporations with a single regression model. The slope, *a*, at the value of 1 is the controlled parameter. It indicates that there is a single-alike behaviour for all companies in explaining their decision-making behaviour.

The relationship between structural control and decisions load is linear. The corporation's regression formed parallel lines in both graphs (Figures 5.2 and 5.3), along with a gradient perpendicular to these lines. This gradient shows the spread of the eight corporations.

Figure 5.3 shows regression lines for all corporations with slope values equal to 1. When structural control increases, the decisions load increases accordingly. The data point at the peak of the regression line belongs to the main holding corporation, the highest point in structural control and decisions load. The subsidiaries' points spread at the lower end of the regression line. The graph shows that the higher the structural control, the higher the decisions load. This

is reflective of the fact that the higher the company in the hierarchy, the more decisions they have to make, mainly the strategic and long-term decisions. So, the burden or the decisions load of the company at the higher hierarchy level in making decisions is larger. Consequently, the company at the lower rank in the hierarchy has a lower decisions load.

It is observed that the same log-linear proportional relationship of structural control (betweenness centrality) over decisions load (stress centrality), with a slope equal to 1, applies to all the corporations. With the global model, three groups appear clearly (Figure 5.3). The three clear groups are: Group 1 – Boustead Holdings (the bottom regression line), Group 2 – Sime Darby, IOI Corporation, KL Kepong, Genting Plantations, and IJM Plantations (the middle regression lines) and Group 3 – Kulim and Jaya Tiasa (the top regression lines). Groups 2 and 3 consist of GLCs and family-owned companies.

Referring to the horizontal and vertical lines in Figure 5.3, the firms have different decisions load at the same point of structural or hierarchical control. A horizontal line made at the structural control axis 6 indicates the same value for all firms. However, the vertical lines at the decisions load axis shows various values, ranging from 3.2 to 8.6 ($S_i^{corp1 \sim corp8}$). The variation in values reflects the decisions load at the same level for all companies. For example, Kulim and Jaya Tiasa have a decisions load that is relatively low, less than four at the same point of hierarchy level 6. Sime Darby, IOI Corp, KL Kepong, Genting Plantations, and IJM Plantations have a medium load (6 to 7) at the hierarchy level 6. Boustead shows the highest load, close to 9 at the hierarchy level 6. All corporations have different decision-making control capacity at the same level of hierarchical control and vice versa. A similar pattern appears when the same level of decisions' load has different structural control ability across all firms.

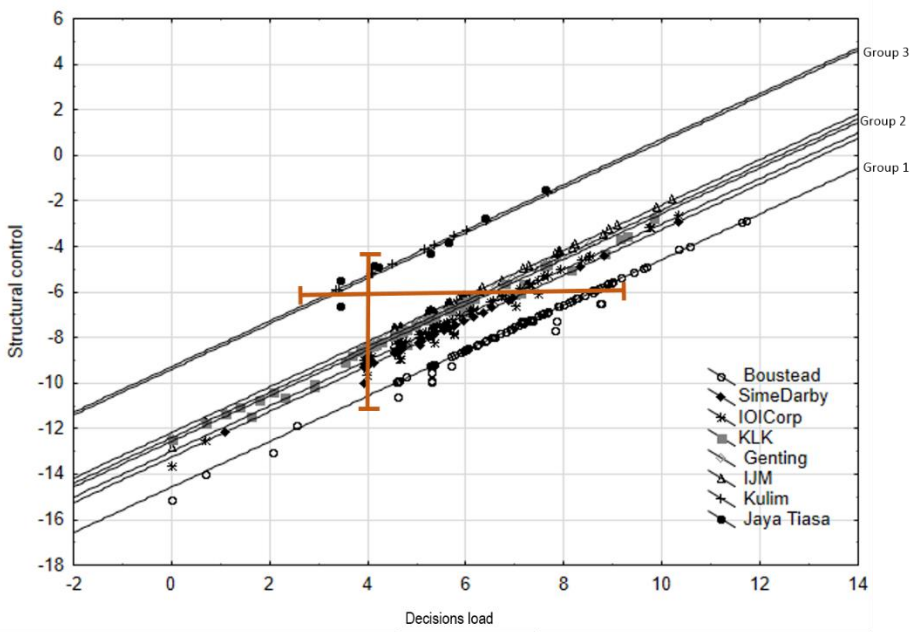

Figure 5.3: Decision-making behaviour for major palm oil corporations using a global model

All corporations' regression lines intercepts the structural control axis at different values (Table 5.5) with given same value for slopes. It shows that given the same decisions load, all corporations show a different level of structural control and vice versa.

Table 5.6: Regression results for the corporations (global model)

	Intercept	SE Intercept	Slope	SE Slope	df	N	SD Intercept	SD Slope	r^2
Boustead	-14.570	0.013	1.000	0.000	536	544	0.295	0.000	0.993
Sime Darby	-13.253	0.018	1.000	0.000	536	544	0.429	0.000	
IOI	-13.009	0.054	1.000	0.000	536	544	1.255	0.000	
KLK	-12.561	0.048	1.000	0.000	536	544	1.113	0.000	
Genting	-12.403	0.025	1.000	0.000	536	544	0.583	0.000	
IJM	-12.179	0.025	1.000	0.000	536	544	0.589	0.000	
Kulim	-9.280	0.024	1.000	0.000	536	544	0.551	0.000	
Jaya Tiasa	-9.405	0.022	1.000	0.000	536	544	0.505	0.000	

There is a common behaviour for all corporations, which is the slope. This research do not delve in defining the slope. It will be defined in a future research. The analysis shows a single fundamental phenomenon which is the same for all corporations, and this phenomenon is the linear relationship between structural control and decisions load. Although there is one consistent phenomenon, there are also variations, which are shown by the different values of the intercepts. The intercepts serve as the ranking for each corporation, knowing that they are all governed by the same proportionality expressed by the slope. The intercepts differentiate for all corporations. The intercepts are identified as the structural flexibility. They have very different structural flexibilities, up to a factor of 3.0. The corporations can be differentiated and ranked by their level of structural flexibility.

As shown in Table 5.5, the intercepts of a global model displayed differences across all corporations. When the decisions load is 0, the structural control in the corporation is at certain values. It means, when there is no decisions communicated in the structure, the control in the structure remained important at certain point. When there is no important control in the structure, the decisions load remained at certain point. This situation is seen as the structural flexibility because, the control of the structure and decisions load in the structure are not stagnant but varying according to their shareholdings structure pattern.

A comparison of the intercepts shows the difference is significant. The fitness of this global model is 99.3%. It indicates that the model is very good for explaining the corporations' decision-making behaviour. This model explains unifying findings by which all corporations are different at structural flexibility (intercepts), but have a common behaviour (slopes) which needs to be understood.

Table 5.6 illustrates that the corporations are all significantly different by the intercepts. A global model is a better statistical model to explain the decision-making behaviour by explaining the relationship between structural control (betweenness) and decisions load (stress).

Among government-linked companies, Boustead Holdings has the lowest structural flexibility (14.57) compared to other federal government-linked companies like Sime Darby, IJM, and Kulim. IJM's and Kulim's businesses are not as diversified as Boustead and Sime Darby. This explains why IJM's and Kulim's structural flexibility are lower, making them more flexible in their operations. Among family-owned companies, IOI Corporation's, KLK's and Genting's structural flexibility are not as low as Jaya Tiasa's. The same justification applies, Jaya Tiasa is less diversified than IOI Corp, KLK and Genting. Based on the analysis, the nature of the ownership does not explain structural flexibility.

Structural flexibility ranks the companies correspondingly to their size. Boustead as the biggest company within this research scope has the lowest structural flexibility, whereas Kulim and Jaya Tiasa are the smallest companies and have

the highest structural flexibility. This research validated the reslationship between structural fexibility and companies' size parameters in the next section.

Table 5.7: Intercepts (flexibility) comparison for eight agribusiness corporations (global model)

Intercept (p value)			Intercept (p value)							
			GLC				Family-owned			
			Boustead	Sime Darby	IJM	Kulim	IOI Corp	KLK	Gen-ting	Jaya Tiasa
	GLC	Boustead	1.000							
		Sime Darby	0.000*	1.000						
		IJM	0.000*	0.000*	1.000					
		Kulim	0.000*	0.000*	0.000*	1.000				
	Family-owned	IOI Corp	0.000*	0.000*	0.000*	0.000*	1.000			
		KLK	0.000*	0.000*	0.000*	0.000*	0.000*	1.000		
		Genting	0.000*	0.000*	0.000*	0.000*	0.000*	0.004*	1.000	
		Jaya Tiasa	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	1.000

Structural control depends more on the topology of the ownership structure than the type of ultimate ownership (government-owned or family-owned). This is aligned with Arrow (1964) who mentioned that a classic business model is overpowered with the coordination of decisions that have a great stress at the central control in large business organisations. For an organisation that has high hierarchical relations for power centralisation, control is exercised by orders from the top and executed in detail by those at the bottom. It is similar to a pyramidal structure which displays a top-down chain of control (La Porta et al., 1999). Ultimate owners are at the top. The pyramid structure allows the ultimate owner to retain control of many firms.

An organisation that has lower hierarchical relation, shows power decentralisation. It is focussed on the allocation of responsibilities vertically and horizontally in the structure, where the span of control are given to those at the middle and bottom to execute needed tasks.

Decentralisation is induced by dispersed ownership. It gives individual owners minimum chance to participate in decision-making since the benefits are shared by all owners in proportion to their holdings (Leech & Leahy, 1991).

Figure 5.4 shows the average structural control and decisions load for the eight corporations. This figure is derived from the average score of the structural control and decisions load in Figure 5.3. Looking at the quadrants in Figure 5.4, six companies are in the first quadrant, signifying high structural control with low decisions load. Of the six, two are government-owned companies, while the other four make up all of the family-owned companies. Sime Darby is in the second quadrant with low structural control with low decisions load. Boustead is in the fourth quadrant, low structural control with relatively high decisions load. This suggests that both Sime Darby's and Boustead's current corporate structure are at a disadvantage compared to the other companies. The disadvantage could be in terms of the size of the group – too big to be highly competitive.

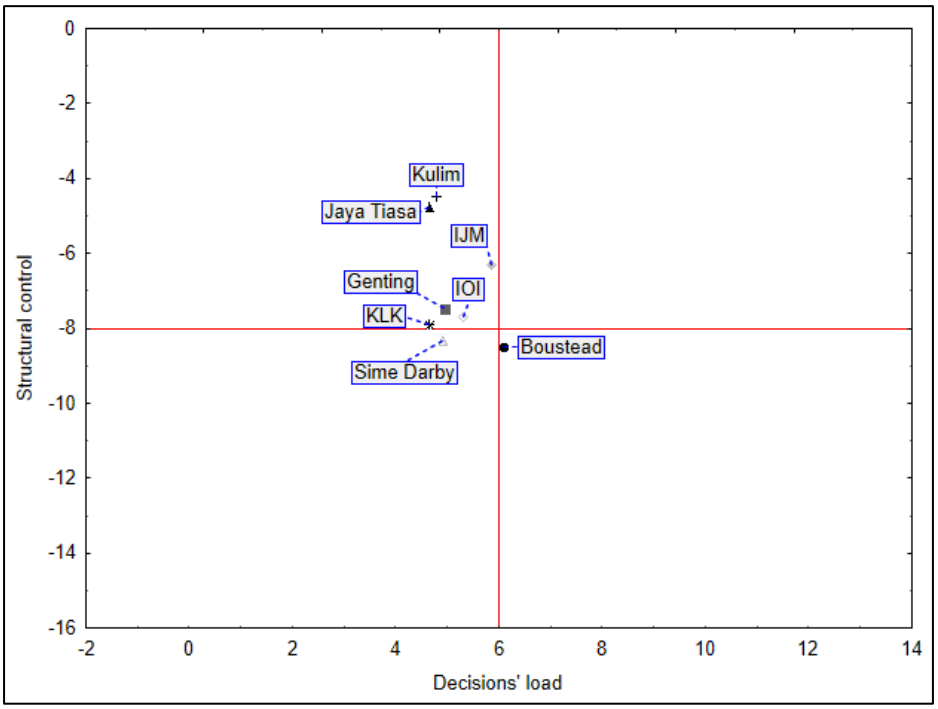

Figure 5.4: Average hierarchical decisions load of major oil palm plantations corporations

Among the GLCs, Kulim is the smallest in terms of size of corporate ownership topology. It contributes to the ability in having higher control (due to less hierarchical structure) and a low load of decisions. That is the key feature of the first quadrant. IJM Plantations has a bigger corporate ownership topology than Kulim but smaller than Sime Darby and Boustead. Sime Darby and Boustead have the lowest control because of their size of corporate ownership topology is the biggest among all companies. They are directly linked to the federal government investment entities, PNB and LTAT. This leads to high social responsibility than the other companies.

Although all of the family-owned companies are in the first quadrant, their average hierarchical decisions load are scattered. It shows they vary in the level of structural control and decisions load. Jaya Tiasa has the highest structural control due to its smaller and leaner corporate ownership topology.

5.2.3 Model Validation

To confirm the findings of the intercepts outlined in the network topology structure, a further regression analysis is performed. This analysis is to study the relationship between structural flexibility (intercepts) and their network topology structure. The relationship between structural flexibility is well explained (r^2

ranging from 0.67 to 0.84) with three network topology metrics, such as the number of nodes (companies), hierarchy index (%), and subsidiaries degree.

The structural flexibility shows a relationship with the number of companies in the corporations (Figure 5.5). The structural flexibility is higher when there is a lesser number of companies in the corporation. It shows that the bigger the number of companies in the group, the less flexible it becomes. The lesser flexibility could be the result from the weight of information flow which is heavier and longer in terms of the chain-of-transferring the information. The pattern of a corporation's tabulation in Figure 5.5 as very similar to the pattern shown in Figure 5.3. The model is 84% accurate in representing the relationship between structural flexibility and the number of companies.

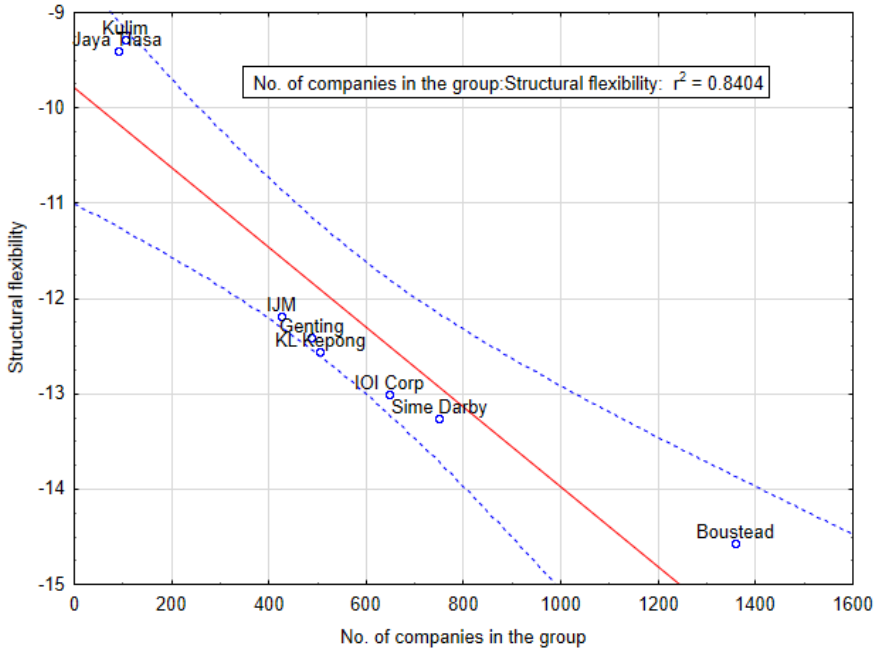

Figure 5.5: Regression analysis between structural flexibility and number of companies in the corporations

The relationship between structural flexibility and the hierarchy index is well-explained (83.7%). The structural flexibility is higher when the hierarchy index is lower (Figure 5.6). When the structure is less hierarchical, the flow of information is faster, and if changes were to be implemented, it can be easily executed as there is less hierarchy level to deal with. The tabulation of the corporations is similar to the grouping of corporations in the linear regression graphs shown previously.

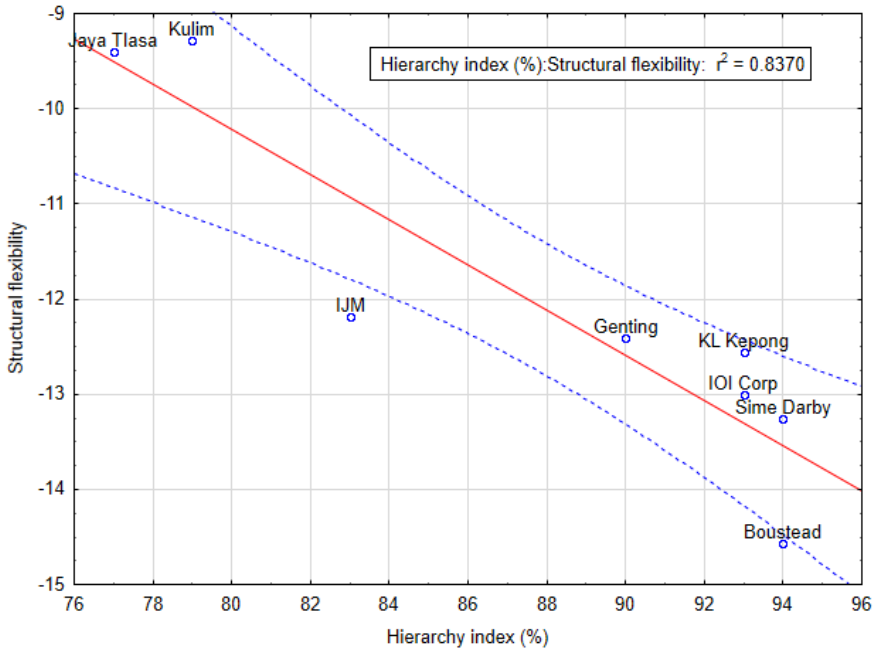

Figure 5.6: Regression analysis between structural flexibility and hierarchy index

The relationship between structural flexibility and level of the ownership pyramid shows a high relationship (78%) (Figure 5.7). The same reason can be derived as in the hierarchy level. When the structure is less pyramidal, the spread of the information is not vast, and relatively easier to manage and control. The tabulation of the corporations has a wider range than the tabulation of previous figures. The structural flexibility becomes less as the tiers in the company's pyramid increases.

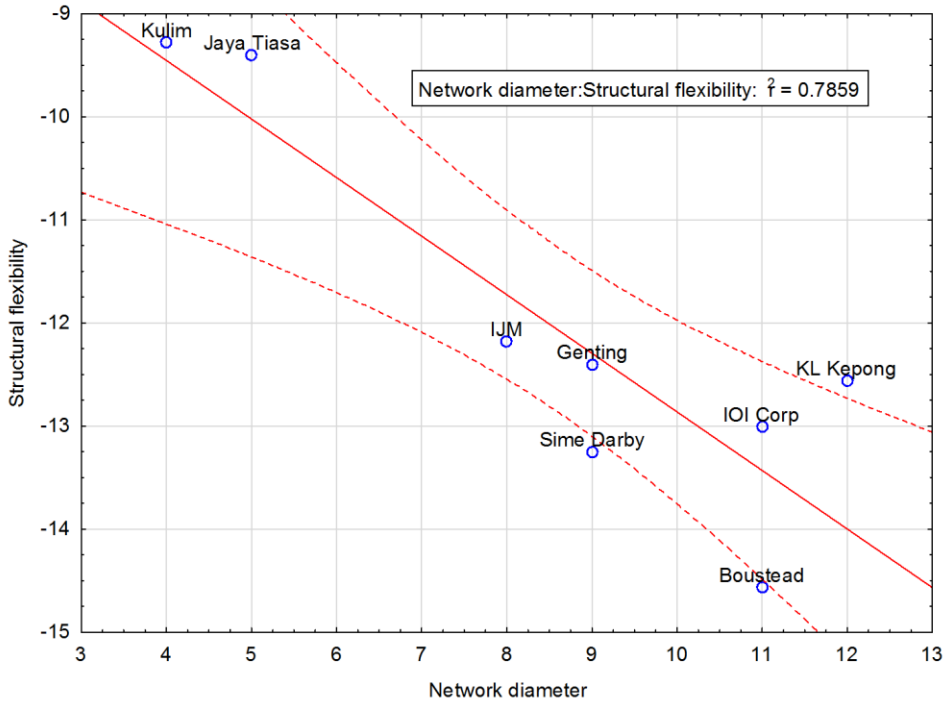

Figure 5.7: Regression analysis between structural flexibility and pyramid levels

These figures confirm that the emerging findings found in the study is very much related to flexibility. The flexibility is well explained with the size of the corporate ownership topology, such as the number of companies in the group, and the hierarchical structure of the group. The study has managed to quantify and qualify the structural control, decisions load, and flexibility based on the companies' shareholdings data.

All of the analysis regarding structural flexibility presented above do not discriminate the companies based on their ownership identity, but more to their ownership structure.

CHAPTER 6

CONCLUSION

This research analyses the links between ownership structures and decision-making behaviour vested in GLCs and FOBs using network analysis. It provides answers to how complex shareholding structures shape decision-making among GLCs and FOBs in the agribusiness and plantations sector. The convoluted shareholding patterns in GLCs and FOBs were analysed to *uncover* how these patterns influence their decision-making behaviour. They are faced with the challenge of balancing financial growth with environmental sustainability. Besides, the global agriculture sector is in the process of financialisation, which increase the role of financial institutions as shareholders. Financialisation increases the complexity of the ownership structure of these firms, including those owned by the government, families or private individuals.

This research concludes by relating the objectives of the study, the research questions with the findings obtained. The objectives and the questions were related to the main problem highlighted. By answering to the objectives and research questions, it is clear that this research was done systematically.

6.1 Analysing The Shareholding Structure In Shaping Decision-Making Behaviour

Research question: How to best describe the ownership structure of the corporations and link to decision-control behaviour?

Network analysis metrics were found to best describe the ownership structure of the corporations. It could be linked to decision-control behaviour. They are the attributes that can help one understand where the control of decision-making lies. These metrics are ownership pyramid level, ownership tier, subsidiaries degree, shareholdings degree, hierarchical index, structural control and decisions load. This research finds that shareholding structures inform the control of the decision-making process in GLCs and FOBs in agribusiness and plantations companies.

Ownership pyramid level, ownership tier, subsidiaries degree, shareholdings degree and hierarchical index were able to help to describe GLCs' and FOBs' decision-making patterns regardless of their ownership identity.

Ownership pyramid level matters because it influences decision-making control. A higher number of pyramid levels indicates a longer chain of information in the decision-making process which leads to inefficiency and less flexibility/resilience. Subsidiaries degree displays the number of subsidiaries owned by the main

holding company. The more subsidiaries the company has, the wider the decision-making control in the structure. Shareholdings degree shows the number of shareholders in the main holding company. The more major shareholders the company has, the more likely the decision-making is potentially heterogeneous. The hierarchical index indicates the level of hierarchy in the business group structure. The higher the hierarchical index, the longer the decision-making flow is, and there is less potential autonomy existing among subsidiaries. Hierarchical layouts for the ownership structure network visuals served as the X-ray images of the corporations.

Betweenness and stress are the main attributes that quantify the structural control and the decisions load explains the decision-making control behaviour. It is clear that the higher the structural control in the corporation, the heavier the decisions load in the structure. When the size of the company increases, so does its decisions load because the number of hierarchy levels increases.

6.2 Analysing the Glcs and Fobs Decision-Making Control Patterns

Research question: Are the GLCs and FOBs ownership structures similar or different?

The ownership structures of eight plantation companies under this study shared some similarities and differences. In all the eight cases, the relationship between the distribution of decision load and the structural control is linear. It means that the higher the hierarchy, the bigger the decisions load are. This phenomenon is not correlated with the ownership identity of the GLC and FOB. It means the size of the corporation's hierarchy does not defined by the type of ownership. Further works can be done in searching for what could define the hierarchy size of the corporation. For example, Boustead and IOI Corporations have more common features in their ownership topology structure. Sime Darby and KL Kepong showed that they are apart from others. Both cases showed that the ownership type is dissassociated with the topology of the corporate stuctures.
The analysis shows that some company structures are common while some are apart. The commonalities signified that the GLCs' and FOBs' structure patterns do not follow the ownership type.

6.3 Ownership Structure Criteria To Explain Decision-Control Behaviour: A Mathematical Relationship Representation Of Glcs And Fobs Decision-Making Behaviour

Research questions:

1) *Is there a general criteria to link to the decision-making control behaviour?*
2) *Can decision-control behaviour be represented by a mathematical relationship?*

Based on the findings, the general criteria to link the decision-making control behaviour is the flexibility that emerged as the property from structural control (betweenness) against the decisions load (stress). Flexibility appeared based on the intercepts of the linear relationship of the network metrics. It linked the two decision-making control behaviour (structural control and decisions load). It could also be employed to rank the corporations, to get the initial interpretation of the behaviour.

The analysis shows that all companies have various flexibility levels. The higher rankings are found in Kulim, a GLC and Jaya Tiasa, a FOB, which have the highest flexibility levels, and show a lighter decisions load and structural control in their structure. The lowest ranking is in Boustead, a GLC, which has the heaviest decisions load and structural control in its corporate structure. The other five companies, consisting of two GLCs and three FOBs are in the middle rankings where their decisions load and structural control are at moderate–high level. It should be noted however that while all corporations have a similar linear pattern of decision-making control, their levels of structural flexibility differ. It means that, although the structural control and decisions load accelerate at a similar pattern, the flexibility occurred varies following the size of the companies.

This research has successfully identified a simple mathematical model for the relationship between structural control and the decision load of GLCs and FOBs in the agribusiness and plantation sector. The model proves that all companies, whether GLCs or FOBs, follow a fundamental structural law where the structural control and the decisions load of the company increase linearly together.

Based on the linear relationship between structural control and the decision load, structural flexibility/resilience can be measured with the intercepts. It indicates that the companies' decision-making behaviour is similar regardless of their ownership identity. All companies display a linear pattern of acceleration in structural control and their decisions load, when the structural control increases, the decisions load increases accordingly. This acceleration pattern does not differentiate the ownership type of the companies, but makes a distinction based on the companies' size. The larger the company, the higher its structural control and decisions load. The variation in size occurs in both GLCs and FOBs.

These differences are correlated with some of the ownership structure attributes identified earlier, such as the number of companies in the business group, the hierarchical index and the pyramidal levels. It can be concluded here that the level of companies' flexibility in the decision-making control is very much dependent on the design of ownership structure, rather than their status as either GLCs or FOBs.

6.4 Significant Findings

There are a few significant findings discovered in this research. Firstly, the mathematical model for the relationship between company's ownership structure and decision-making behaviour. The model was applied to all companies studied in this research which are a part of Malaysia's agribusiness and plantation sector. This model can be applied to understand decision-making behaviour of companies in other sectors. The production of a mathematical model shows that this research can be replicated as well as improved.

The findings of this research can be beneficial for companies because they can use the model to analyse their decision-making process and determine their level of flexibility and resilience. The model can also be employed to identify current and future potential weaknesses in a company's structure and decision-making behaviour. It opens a further research path to extend the scope of the study, and further explore the limitations identified in this research.

Secondly, this research finds that there is no significant difference in GLCs and FOBs decision-making behaviour. All companies followed the linear pattern of increase in structural control and decisions load, at their own pace. The tabulation of the companies did not differentiate their ownership identity, but their size. This finding is significant to the discussion of privatisation of government-owned companies. In this case, privatisation may not improve the decision-making control of the company. Besides, this finding is relevant for carrying out merger and acquisition process of a company, where it shows that the size of a company reflects the flexibility and the decision-making control.

Thirdly, this research discovers that the corporate structure defines the corporate decision-making behaviour. The chain-of-control in a company's decision-making resides in the corporate structure. In understanding the complexities in the corporate structure, it is important to apply a tool that can decipher the complexities and be able to discover the important features in the structure which relate to the decision-making control. This finding is significant because it discovers a new perspective in understanding the complexity of the corporate structure and corporate decision-making behaviour using a quantitative tool.

6.5 Implications of The Findings

The implications of the findings to the government, investors, and company performance are evident in some ways. The government has dual role in the plantation sector, the owner, via the shareholdings of the plantation corporations through the GLICs, and the regulatory body of the sector. The findings did not delve into the regulatory aspect of the government. It is evident that the corporations' ownership structure could draw some meanings to the governance of the corporations. It shows little regulations on the topology of the ownership

structure, especially in terms of size of the corporations, and the concentration of shares.

As for the investors, the findings could be employed as one of the tool to assess the flexibility or the decision control behaviour of any business sector. Even though it will not be complete and comprehensive, but it could provide the baseline knowledge of economic sector behaviour in terms of their ownership structure.

Based on the research findings, the ownership structure plays important role towards company performance. This can be seen through the flexibility index emerged from the results, where it indicates the strengths and weaknesses of each of the corporation's structure. We assumed, the strengths could boost the performance, for example, if the corporation has a high flexibility in their decision-making behaviour, they could adapt to the market changes at ease compared to the least flexible decision-making behaviour.

6.6 Research Limitations

While this research has generated revolutionary findings in the field of agriculture business and management, it has some limitations. The first is the selection of the agribusiness companies. There are about 50 public-listed agribusiness companies in Malaysia, but this research selects only eight major companies. The research needs ten levels shareholdings data to accomplish holistic results, which makes studying all 50 companies unfeasible. Besides, the remaining 42 companies are medium and small plantations with market capitalisation value less than RM1 billion. The research operates on the assumption that these major eight companies can represent all agribusiness companies in Malaysia.

Secondly, this research is multidisciplinary. It involves different fields of studies such as business, economy and management studies, political business, and complex network studies. The scope of the research is relatively new. Experts who deal with all three disciplines are limited. Therefore, there is room for expansion in this scope of the research.

6.7 Recommendations

Based on the results, several research projects can emerge from this research. First, as the research does not define the slope of the linear relationship of structural control and decisions load, future studies can take up the task to explore further the meaning of the slope. This can provide a greater depth of understanding of the current findings and analysis.

Secondly, while the thesis has been written in 2017, the data for this research was based on the 2013 company reports. This research can be further developed by using a more recent set of data.

Thirdly, the research do not measure the controlling power of the corporations. There are a few methods to calculate and analyse this power based on network centralities, such as Eigenvector and Bonacich. It will be valuable to identify and analyse the controlling power among the corporations within a sector, or a country, to better understand corporate networks.

BIBLIOGRAPHY

Abdul Rahman, R. (2006). *Effective corporate governance* (1st ed.). Shah Alam, Malaysia: University Publication Centre (UPENA), Universiti Teknologi MARA.

Albert, R., & Barabasi, A.L. (2002). Statistical mechanics of complex networks. *Reviews of Modern Physics, 74*(1), 47–97. https://doi.org/10.1103/RevModPhys.74.47

Almeida, H., & Wolfenzon, D. (2006). A theory of pyramidal ownership and family business groups. *The Journal of Finance, 61*(6), 2637–2680.

Almeida, H., Park, S.Y., Subramanyam, M., & Wolfenzon, D. (2008). *Beyond cash flow and voting rights: Valuation and performance of firms in complex ownership structures*. Working paper, University of Illinois at Urbana-Champaign and Stern School of Business at NYU.

Almeida, H., Park, S.Y., Subramanyam, M., & Wolfenzon, D. (2011). The structure and formation of business groups: Evidence from Korean *chaebols*. *Journal of Financial Economics, 99*(2), 447–475. http://dx.doi.org/10.1016/j.jfineco.2010.08.017

Alwshah, K.A.A.M. (2009). *The impact of corporate governance and ownership structure on performance and financial decisions of firms: Evidence from Jordan* (Doctoral thesis, University of Hull, United Kingdom). Retrieved from https://hydra.hull.ac.uk/resources/hull:6971

Amihud, Y., & Lev, B. (1999). Does corporate ownership structure affect its strategy towards diversification? *Strategic Management Journal, 20*(11), 1063–1069. doi: 10.1002/(SICI)1097-0266(199911)20:11<1063::AID-SMJ69>3.0.CO;2-S

Anderson, R.C., & Reeb, D.M. (2003). Founding-family ownership and firm performance: Evidence from the S&P 500. *The Journal of Finance, 58*(3), 1301–1328.

Ang, J.S., & Ding, D.K. (2006). Government ownership and the performance of government-linked companies: The case of Singapore. *Journal of Multinational Financial Management, 16*(1), 64–88. https://doi.org/10.1016/j.mulfin.2005.04.010

Anseeuw, W., Jean-Marc, R., Antoine, D., & Norfaryanti, K. (2016). Strategies globales des firmes et financiarisation de l'agriculture. In B. Estelle, R. Alain, & L. Denis (Eds.), *Developpement durable et filieres tropicales* (pp. 321-337). Paris: Cirad.

Anthonisse, J.M. (1971) *The rush in a graph* (Technical report). Amsterdam: University of Amsterdam Mathematical Centre.

Ariffin, B. (2009). Pyramidal ownership structure and agency problem: Theory and evidence. *Integration and Dissemination, 4*(March), 9–18.

Arrow, K. (1964). Control in large organizations. *Management Science, 10*(3), 397–408.

Assenov, Y., Ramírez, F., Schelhorn, S.E., Lengauer, T., & Albrecht, M. (2008). Computing topological parameters of biological networks. *Bioinformatics, 24*(2), 282–284. doi: 10.1093/bioinformatics/btm554

Astrachan, J.H., & Shanker, M.C. (2003). Family businesses' contribution to the U.S. economy: A closer look. *Family Business Review, 16*(3), 211–219. doi: 10.1111/j.1741-6248.2003.tb00015.x

Basiron, Y. (2007). Palm oil production through sustainable plantations. *European Journal of Lipid Science and Technology, 109*(4), 289–295.

Bastian, M., Heymann, S., & Jacomy, M. (2009). *Gephi: An open source software for exploring and manipulating networks*. Paper presented at the Third International AAAI Conference on Weblogs and Social Media, San Jose Mc Energy Convention Center, California. Retrieved from http://www.aaai.org/ocs/index.php/ICWSM/09/paper/view/154%5Cnpapers2://publication/uuid/CCEBC82E-0D18-4FFC-91EC-6E4A7F1A1972

Bebchuk, L.A., Kraakman, R., & Triantis, G.G. (2000). Stock pyramids, cross-ownership, and dual class equity: The mechanisms and agency costs of separating control from cash-flow rights. In R. Morck (Ed.), *Concentrated corporate ownership* (pp. 295–315). Chicago, IL: University of Chicago Press.

Beckhard, R., & Dyer, W.G., Jr. (1983). Managing continuity in the family owned business. *Organizational Dynamics, 12*(1), 5–12. https://doi.org/10.1016/0090-2616(83)90022-0

Berle, A.A. (1968). Corporate decision-making and social control. *The Business Lawyer, 24*(1), 149–157.

Berle, A.A., & Means, C.G. (1932). *The modern corporation and private property*. New York, NY: Macmillan.

Bertrand, M., & Mullainathan, S. (2003). Pyramids. *Journal of the European Economic Association, 1*(2–3), 478–483.

Bhasin, M.L. (2010). Dharma, corporate governance and transparency: An overview of the Asian markets. *International Journal of Business and*

Management, 5(6), 56–73. Retrieved from http://ccsenet.org/journal/index.php/ijbm/article/view/6228/4922

Blair, M.M. (1995). *Ownership and control: Rethinking corporate governance for the twenty-first century*. Washington, DC: Brookings Institution Press.

Boccaletti, S., Latora, V., Moreno, Y., Chavez, M., & Hwang, D.-U (2006). Complex networks: Structure and dynamics. *Physics Reports, 424*(4–5), 175–308.

Bohlin, L. (2012). *Network analysis of the share ownership structure on the Swedish stock market* (Master's thesis, Department of Physics, Umeå University, Umeå, Sweden). Retrieved from www.diva-portal.org/smash/get/diva2:536031/FULLTEXT01.pdf

Bonacich, P. (1972). Factoring and weighting approaches to status scores and clique identification. *Journal of Mathematical Sociology, 2*(1), 113–120. https://doi.org/10.1080/0022250X.1972.9989806

Bonacich, P. (1987). Power and centrality: A family of measures. *American Journal of Sociology, 92*(5), 1170–1182.

Bonacina, F., D'Errico, M., Moretto, E., Stefani, S., Torriero, A., & Zambruno, G. (2015). A multiple network approach to corporate governance. *Quality & Quantity, 49*(4), 1585–1595. http://dx.doi.org/10.1007/s11135-014-0075-y

Borgatti, S.P., & Everett, M.G. (2006). A Graph-theoretic perspective on centrality. *Social Networks, 28*(4), 466–484. https://doi.org/10.1016/j.socnet.2005.11.005

Boustead Holdings Berhad. (2013). *Annual Report, 2012*. Kuala Lumpur: Author.

Boutchkova, M.K., & Cueto, D. (2007). *Ownership structure mobility of Canadian business groups*.

Bunkanwanicha, P., Gupta, J., & Wiwattanakantang, Y. (2016). Pyramidal group structure and bank risk in Thailand. *Journal of Comparative Economics, 44*(2), 272–288. https://doi.org/10.1016/j.jce.2015.12.002

Burkart, M., Panunzi, F., & Shleifer, A. (2003). Family firms. *The Journal of Finance,58*(5), 2167–2201. doi: 10.1111/1540-6261.00601

Burt, R.S. (1992). *Structural holes: The social structure of competition*. Cambridge, MA: Harvard University Press.

Carlsson, B. (1989). Small-scale industry at a crossroads: US machine tools in global perspective (Research program in industrial economics working paper). Cleveland, Ohio: Case Western Reserve University.

Chandler, A.D. (1962). *Strategy and structure: Chapters in the history of the American industrial enterprise*. New York, NY: Doubleday.

Chandler, A.D. (1977). *The visible hand: The managerial revolution in American Business*. Cambridge, MA: Harvard University Press.

Chandler, A.D. (1982). The M-form: Industrial groups, American style. *European Economic Review, 19*(1), 3–23. https://doi.org/10.1016/0014-2921(82)90003-4

Chapelle, A., & Szafarz, A. (2005). Controlling firms through the majority voting rule. *Physica A: Statistical Mechanics and its Applications, 355*(2–4), 509–529.

Chen, G., Firth, M., & Xu, L. (2009). Does the type of ownership control matter? Evidence from China's listed companies. *Journal of Banking and Finance, 33*, 171-181.

Chen, L. (2012). *The effect of ownership structure on firm performance: Evidence from non-financial listed companies in Scandinavia* (MSc thesis, Aarhus University, Aarhus, Denmark).

Child, J. (1972). Organizational structure, environment and performance: The role of strategic choice. *Sociology*, 6(1), 1–22.

Chu, W. (2009). The influence of family ownership on SME performance: Evidence from public firms in Taiwan. *Small Business Economics, 33*(3), 353-373. https://doi.org/10.1007/s11187-009-9178-6

Chua, J.H., Chrisman, J.J., & Sharma, P. (1999). Defining the family business by behavior. *Entrepreneurship: Theory & Practice*, 23, 19–39.

Churchill, N.C., & Hatten, K.J. (1987). Non-market-based transfer of wealth and power: A research framework for family businesses. *American Journal of Small Business*, 11(3), 51–64.

Claessens, S., Djankov, S., & Lang, H.P. (1999). Who controls East Asian corporations—and the implications for legal reform. *Public Policy for the Private Sector*, 1–8.

Connelly, B.L., Hoskisson, R.E., Tihanyi, L., & Certo, S.T. (2010). Ownership as a form of corporate governance. *Journal of Management Studies, 47*(8), 1561–1589. doi: 10.1111/j.1467-6486.2010.00929.x

Connelly, J.T., Limpaphayom, P., & Nagarajan, N.J. (2012). Form versus substance: The effect of ownership structure and corporate governance on firm value in Thailand. *Journal of Banking and Finance, 36*(6), 1722–1743. https://doi.org/10.1016/j.jbankfin.2012.01.017

Cross, R., Liedtka, J., & Weiss, L. (2005). A practical guide to social networks. *Harvard Business Review, 83*(3), 124–132.

Cull, R., Matesova, J., & Shirley, M. (2001). *Ownership structure and the temptation to loot: Evidence from privatized firms in the Czech Republic* (World Bank Policy Research Working Paper). Washington DC: World Bank. https://doi.org/10.1596/1813-9450-2568

da Costa, L.F., Rodrigues, F.A., Travieso, G., & Villas Boas, P.R. (2007). Characterization of complex networks: A survey of measurements. *Advances in Physics, 56*(1), 167–242.doi: 10.1080/00018730601170527

Daily, C.M., & Dollinger, M.J. (1992). An empirical examination of ownership structure in family and professionally managed firms. *Family Business Review, 5*(2), 117–136. https://doi.org/10.1111/j.1741-6248.1992.00117.x

Daniels, P.W. (1983), Business service offices in British provincial cities: Location and control. *Environment and Planning A: Economy and Space, 15*(8), 1101–1120. https://doi.org/10.1068/a151101

Davis, J.H., & Goldberg, R.A. (1957). *A concept of agribusiness*. Boston: Division of Research, Graduate School of Business Administration, Harvard University.

de Masi, G., & Gallegati, M. (2012). Bank-firms topology in Italy. *Empirical Economics, 43*(2), 851–866. https://doi.org/10.1007/s00181-011-0512-x

de Nooy, W., Mrvar, A., & Batagelj, V. (2005). *Exploratory social network analysis with Pajek*. Cambridge: Cambridge University Press.

Dean, J.W., & Sharfman, M.P. (1996). Does decision process matter? A study of strategic decision-making effectiveness. *The Academy of Management Journal, 39*(2), 368–396.

Demsetz, H. (1983). The structure of ownership and the theory of the firm. The *Journal of Law & Economics, 26*(2), 375–390.

Denis, D.J., Denis, D.K., & Sarin, A. (1997). Ownership structure and top executive turnover. *Journal of Financial Economics, 45*(2), 193–221. https://doi.org/10.1016/S0304-405X(97)00016-0

Department of Statistics Malaysia. (2017). *Selected agricultural indicators, Malaysia, 2017*. Putrajaya: Author.

Dyer, W.G. (1988). Culture and continuity in family firms. *Family Business Review, 1*(1), 37–50.

Evans, P. (1999). Transferable lessons? Re-examining the institutional prerequisites of East Asian economic policies. In Y. Akyuz (Ed.), *East Asian development: New perspectives*. London: Frank Cass.

Faccio, M., & Lang, L.H.P. (2002). The ultimate ownership of Western European corporations. *Journal of Financial Economics, 65*(3), 365–395. https://doi.org/10.1016/S0304-405X(02)00146-0

Fama, E.F., & Jensen, M.C. (1983). Separation of ownership and control. *The Journal of Law and Economics, 26*(2), 301–325.

Favero, C.A., Giglio, S.W., Honorati, M., & Panunzi, F. (2006). *The performance of Italian family firms* (ECGI Finance Working Paper No. 127/2006). Brussels: European Corporate Governance Institute.

Ferreira, D., Ornelas, E., & Turner, J.L. (2007). Unbundling ownership and control (ECGI Finance Working Paper No. 172/2007). Brussels: European Corporate Governance Institute.

Fligstein, N. (2001). *The architecture of markets: An economic sociology of twenty-first-century capitalist societies*. Princeton, NJ: Princeton University Press.

Forbes, D.P., & Milliken, F.J. (1999). Cognition and corporate governance: Understanding boards of directors as strategic decision-making groups. *The Academy of Management Review, 24*(3), 489–505.

Freeman, L.C. (1977). A set of measures of centrality based on betweenness. *Sociometry, 40*(1), 35–41. doi: 10.2307/3033543

Freeman, L.C. (1978). Centrality in social networks. *Social Networks, 1*(3), 215–239. https://doi.org/10.1016/0378-8733(78)90021-7

Freeman, L.C. (2008). Going the wrong way on a one-way street: Centrality in physics and biology. *Journal of Social Structure, 9*(2), 1–15.

Friedkin, N.E., & Johnsen, E.C. (1990). Social influence and opinions. Journal of Mathematical Sociology 15(3-4), 193–206. doi: 10.1080/0022250X.1990.9990069

Genting Plantations Berhad. (2013). *Annual report, 2012*. Kuala Lumpur: Author.

Ghazali, N.A.M. (2007). Ownership structure and corporate social responsibility disclosure: Some Malaysian evidence. *Corporate Governance: The international journal of business in society, 7*(3), 251–266. https://doi.org/10.1108/14720700710756535

Glattfelder, J.B. (2010). *Ownership networks and corporate control: Mapping economic power in a globalized world* (Doctoral thesis, ETH Zurich, Switzerland). https://doi.org/10.3929/ethz-a-006208696

Glattfelder, J.B., & Battiston, S. (2009). Backbone of complex networks of corporations: The flow of control. *Physical Review E - Statistical, Nonlinear, and Soft Matter Physics, 80*(3), 1–12. doi: 10.1103/PhysRevE.80.036104

Gomez, E.T. (1990). *Politics in business: UMNO's corporate investments*. Kuala Lumpur: Forum.

Gomez, E.T. (2002). Political business in Malaysia: Party factionalism, corporate development and economic crisis. In Edmund Terence Gomez (Ed.), *Political business in East Asia* (pp. 82–114). London: Routledge.

Gomez, E.T., & Jomo, K.S. (1997). Malaysia's political economy: Politics, patronage, profits. Cambridge: Cambridge University Press.

Gomez, E.T., Padmanabhan, T., Kamaruddin, N., Bhalla, S., & Fisal, F. (2017). *Minister of Finance Incorporated: Ownership and control of corporate Malaysia*. Kuala Lumpur and Petaling Jaya: Institute for Democracy and Economic Affairs (IDEAS) and Strategic Information and Research Development Centre (SIRD), Petaling Jaya.

Gomez., E.T., & Saravanamuttu, J. (Eds). (2013). *The New Economic Policy in Malaysia: Affirmative action, horizontal inequalities and social justice*. Singapore: National University of Singapore Press.

Gorriz, C.G., & Fumas, V.S. (1996). Ownership structure and firm performance: Some empirical evidence from Spain. *Managerial and Decision Economics, 17*(6), 575–586. doi: 10.1002/(SICI)1099-1468(199611)17:6<575::AID-MDE778>3.0.CO;2-N

Graham, J.R., Harvey, C.R., & Puri, M. (2013). Managerial attitudes and corporate actions. *Journal of Financial Economics, 109*(1), pp.103–121. https://doi.org/10.1016/j.jfineco.2013.01.010

Granovetter, M. (1995). Coase revisited: Business groups in a modern economy. *Industrial and Corporate Change, 4*(1), 93–130. https://doi.org/10.1093/icc/4.1.93

Gribkovskaia, I., Øyvind H. Sr., & Laporte, G. (2007). The bridges of Königsberg—a historical perspective. *Networks, 49*(3), 199–203. doi: 10.1002/net.20159

Gursoy, G., & Aydogan, K. (2002). Equity ownership, risk taking and performance: An empirical investigation in Turkish listed companies. *Emerging Markets Finance and Trade, 38*(6), 6–25.

Hanim Adnan. (2017, September 16). IOI Corp and Bunge in win-win deal. *The Star*. Retrieved from https://www.thestar.com.my/business/business-news/2017/09/16/ioi-corp-and-bunge-in-winwin-deal/

Hart, A.G. (1942). Risk, uncertainty and unprofitability of compounding probabilities. In O. Lange, F. McIntyre, & T. Yntema (Eds.), *Studies in mathematical economics and econometrics* (pp. 110-118). Chicago: University of Chicago Press.

Hart, Albert G. (1965). *Anticipations, uncertainty and dynamic planning.* New York: Kelley.

Hill, C.W.L. (1988). Corporate control type, strategy, size and financial performance. *Journal of Management Studies, 25*(5), 403–417. doi: 10.1111/j.1467-6486.1988.tb00707.x

Hill, C.W.L., & Snell, S. (1989). Effects of ownership structure. The *Academy of Management Journal, 32*(1), 25–46.

Howard, P.H. (2009). Visualizing consolidation in the global seed industry: 1996–2008. *Sustainability, 1*(4), 1266–1287. doi: 10.3390/su1041266

Hubbell, Charles H. (1965). An input-output approach to clique identification. *Sociometry, 28*(4), 377–399.

Hunt, E., & Sherman, H. (1972). Value, alienation, and distribution. *Science & Society, 36*(1), 29-48.

Ibrahim, H., & Samad, F.A. (2011). Corporate governance mechanisms and performance of public-listed family-ownership in Malaysia. *International Journal of Economics and Finance, 3*(1), 105–115.

IJM Corp. (2015). *Annual report, 2014*. Petaling Jaya, Selangor: Author.

IJM Plantations Berhad. (2013). *Annual report, 2012*. Sandakan, Sabah: Author.

IOI Corporations Berhad. (2013). *Annual report, 2012*. Putrajaya: Author.

Jacob M. Anthonisse. (1971). *The rush in a directed graph*. Technical Report BN 9/71, Stichting Mathematisch Centrum, 2e Boerhaavestraat 49 Amsterdam

Jasani, N.K. (2002). *Malaysia's family businesses: The family and the Business International Survey Report*. Kuala Lumpur: Shamsir Jasani Grant Thorton & Malaysian Institute of Management.

Jaya Tiasa Holdings Berhad. (2013). *Annual report 2012*. Sibu, Sarawak: Author.

Jensen, M.C., & Meckling, W.H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics, 3*(4), 305–360. https://doi.org/10.1016/0304-405X(76)90026-X

Jensen, M.C., & Meckling, W.H. (1992). *Specific and general knowledge and organizational structure* (SSRN research paper). Retrieved from http://papers.ssrn.com/sol3/papers.cfm?abstract_id=6658

Kirchoff, B.A., & Kirchoff, J.J. (1987). Family contributions to productivity and profitability in small business. *Journal of Small Business Management, 25*(4), 25–31.

Kogut, B. (1985). Designing global strategies: Profiting from operational flexibility. *Sloan Management Review, 27*(1), 27–38.

Koschützki, D., Lehmann, K.A., Peeters, L., Richter, S., Tenfelde-Podehl, D., & Zlotowski, O. (2005). Centrality indices. In U. Brandes, & T. Erlebach (Eds.), *Network analysis: Methodological foundations (Volume 3418 of Lecture Notes in Computer Science Tutorial)* (pp. 16–61). Berlin: Springer.

Kuala Lumpur-Kepong Berhad. (2013). *Annual Report 2012*. Ipoh, Perak: Author

Kulim Berhad. (2013). *Annual Report 2012*. Johor Bahru, Johor: Author.

La Porta, R., Lopez-De-Silanes, F., & Shleifer, A. (1999). Corporate ownership around the world. *The Journal of Finance, 54*(2), 471–517. doi: 10.1111/0022-1082.00115

Laeven, L., & Levine, R. (2008). Complex ownership structures and corporate valuations. *The Review of Financial Studies, 21*(2), 579–604. https://doi.org/10.1093/rfs/hhm068

Lane, P.J., Cannella, A.A., & Lubatkin, M.H. (1998). Agency problems as antecedents to unrelated mergers and diversification: Amihud and Lev reconsidered. *Strategic Management Journal, 19*(6), 555–578. doi: 10.1002/(SICI)1097-0266(199806)19:6<555::AID-SMJ955>3.0.CO;2-Y

Lansberg, I.S., Perrow, E.L., & Rogolsky, S. (1988). Family business as an emerging field. *Family Business Review, 1*(1), 1–8. https://doi.org/10.1111/j.1741-6248.1988.00001.x

Lee, C.H. (1990). Corporate behaviour in theory and history: I. The evolution of theory. *Business History, 32*(1), 17–31. https://doi.org/10.1080/00076799000000002

Lee, J. (n.d.). *Changes in the ownership structure of Asian corporations post-Asian financial crisis*. GREThA - UMR CNRS 5113. Bordeaux, France: Montesquieu University - Bordeaux IV.

Leech, D., & Leahy, J. (1991). Ownership structure, control type classifications and the performance of large British companies. *Economic Journal, 101*(409), 1418–1437.

Leff, N.H. (1978). Industrial organization and entrepreneurship in the developing countries: The economic groups. *Economic Development and Cultural Change, 26*(4): 661–675. https://doi.org/10.1086/451052

Levy, M. (2009). Control in pyramidal structures. *Corporate Governance: An International Review, 17*(1), 77–89. doi: 10.1111/j.1467-8683.2008.00719.x

Li, Z., & Wu, S. (2010). An empirical research on ownership structure, board governance and corporate growth. In *Proceedings of 2010 International Conference on Management and Service Science*. Wuhan, China: MASS 2010.

Lim, M.H. (1981). *Ownership and control of the one hundred largest corporations in Malaysia*. Kuala Lumpur: Oxford University Press.

Lim, S.H. (2012). *Ownership structure and concentration and the timeliness of corporate earnings: Malaysian evidence* (Masters thesis, Queensland University of Technology, Brisbane, Australia).

Lindblom, C. (1977). *Politics and markets: The world's political- economic systems*. New York: Basic Books.

Lu, Y., & Yao, J. (2006). Impact of state ownership and control mechanisms on the performance of group affiliated companies in China. *Asia Pacific Journal of Management, 23*(4), 485–503. doi: 10.1007/s10490-006-9017-0

Mansor, N., Che-Ahmad, A., Ahmad-Zaluki, N.A., & Osman, A.H. (2013). Corporate governance and earnings management: A study on the Malaysian family and non-family owned PLCs. *Procedia Economics and Finance, 7*, 221–229. https://doi.org/10.1016/S2212-5671(13)00238-4

Martz, D.J.F., & Semple, R.K. (1985). Hierarchical corporate decision-making structure within the Canadian urban system: The case of banking. *Urban Geography, 6*(4), 316–330. https://doi.org/10.2747/0272-3638.6.4.316

Miles, R.E., Snow, C.C., Meyer, A.D., & Coleman, H.J. (1978). Organizational strategy, structure, and process. *Academy of Management Review, 3*(3), 546–562. doi: 10.5465/AMR.1978.4305755

Miles, R.H. (1982). *Coffin nails and corporate strategies*. Englewood Cliffs, NJ: Prentice-Hall.

Miller, D., & LeBreton-Miller, I. (2005). *Managing for the long run: Lessons in competitive advantage from great family businesses*. Boston, MA: Harvard Business School Publishing.

Miller, E.J., & Rice, A.K. (1967). *Systems of organizations: The control of task and sentient boundaries*. London: Tavistock Publications.

Mishra, C.S., Randoy, T., & Jenssen, J.I. (2001). The effect of founding family influence on firm value and corporate governance. *Journal of International Financial Management & Accounting, 12*(3), 235-259. doi: 10.1111/1467-646X.00073

Moebert, J., & Tydecks, P. (2007). *Power and ownership structures among German companies: A network analysis of financial linkages* (Darmstadt Discussion Papers in Economics 179). Darmstadt, Germany: Darmstadt University of Technology.

Morck, R., & Yeung, B. (2004). Family control and the rent-seeking society. *Entrepreneurship Theory and Practice, 28*(4), 391–409. doi: 10.1111/j.1540-6520.2004.00053.x

Murtha, T.P., & Lenway, S.A. (1994). Country capabilities and the strategic state: How national political institutions affect multinational corporations' strategies. *Strategic Management Journal, 15*(Supplement S2), 113–129. doi: 10.1002/smj.4250151008

Newman, M.E.J. (2001). Scientific collaboration networks. II. Shortest paths, weighted networks, and centrality. *Physical Review E, 64*(1), 016132-1–016132-7. https://doi.org/10.1103/PhysRevE.64.016132

Newman, M.E.J. (2010). *Networks: An introduction*. New York: Oxford University Press.

Newman, M.E.J., & Park, J. (2003). Why social networks are different from other types of networks. *Physical Review E, 68*(3), 036122-1–036122-9. https://doi.org/10.1103/PhysRevE.68.036122

Newman, M.E.J., Watts, D.J., & Strogatz, S.H. (2002). Random graph models of social networks. *Pnas*, 99(Suppl 1), 2566–2572. doi: 10.1073/pnas.012582999

Obata, S. (2003). *Pyramid business groups in East Asia: Insurance or tunneling?* (CEI Working Paper Series, No. 2002-13). Tokyo, Japan: Institute of Economic Research, Hitotsubashi University.

OECD. (2013). Malaysia – *OECD investment policy review*. Paris, France: Author.

Owen-Smith, J., Cotton-Nessler, N.C., & Buhr, H. (2015). Network effects on organizational decision-making: Blended social mechanisms and IPO withdrawal. *Social Networks*, 41(May), 1–17. http://dx.doi.org/10.1016/j.socnet.2014.11.004

Prowse, S.D. (1992). The structure of corporate ownership in Japan. *The Journal of Finance, 47*(3), 1121–1140. doi: 10.2307/2328979

Puthucheary, J.J. (1960). *Ownership and control in the Malayan economy*. Singapore: Eastern Universities Press.

Ramanujam, V., Venkatraman, N., & Camillus, J. (1986). Multi-objective assessment of effectiveness of strategic planning: A discriminate analysis approach. *Academy of Management Review, 29*(2), 347-372.

Robinson, R.B., & Pearce, J.A. (1983). The impact of formalized strategic planning on financial performance in small organizations. *Strategic Management Journal 4*(3), 197–207. doi: 10.1002/smj.4250040302

Roda, J.M., Kamaruddin, N., & Tobias, R.P. (2015). Deciphering corporate governance and environmental commitments among Southeast Asian transnationals: Uptake of sustainability certification. *Forests, 6*(5), 1454–1475. doi: 10.3390/f6051454

Roe, M.J. (1993). Some differences in corporate structure in Germany, Japan, and the United States. *The Yale Law Journal, 102*(8), 1927-2003. doi: 10.2307/796856

Salvaj, E., & Lluch, A. (2011). *Corporate networks in turbulent environments: A comparative study of interlocking directorates of Argentina and Chile (1970)*. *Paper presented at the 15th Annual Conference of the European Business History Association* (pp. 24–26), Athens, Greece.

Sarkar, R. (2008). Public policy and corporate environmental behaviour: A broader view. *Corporate Social Responsibility and Environmental Management, 15*(5), 281–297. doi: 10.1002/csr.167

Scardoni, G., & Laudanna, C. (2012). Centralities based analysis of complex networks. In Yagang Zhang (Ed.), *New frontiers in Graph Theory* (pp. 323–348). London: INTECH. http://dx.doi.org/10.5772/35846

Schweitzer, F., Fagiolo, G., Sornette, D., Vega-Redondo, F., Vespignani, A., & White, D.R. (2009). Economic networks: The new challenges. *Science, 325*(5939), 422–425. doi: 10.1126/science.1173644

Scott, J. (1997). Corporate business and capitalist classes. London: Oxford University Press.

Serrat, O. (2009). Social network analysis. In Olivier Serrat, *Knowledge Solutions: Tools, Methods, and Approaches to Drive Organizational Performance* (pp. 39–43). Singapore: Springer. https://doi.org/10.1007/978-981-10-0983-9

Sexton, D., & van Aucken, P. (1982). Prevalence of strategic planning in small business. *Journal of Small Business Management, 20*(1), 20–26.

Sharifi, N. (2014). *The ownership structure and control mechanisms in Sweden: Case study of leading pyramidal corporations* (Master's thesis, Eastern Mediterranean University). Retrieved from http://hdl.handle.net/11129/1436

Sharma, P., Chrisman, J.J., & Chua, J.H. (1997). Strategic management of the family business: Past research and future challenges. *Family Business Review, 10*(1), 1–35. doi: 10.1111/j.1741-6248.1997.00001.x

Shimbel, A. (1953). Structural parameters of communication networks. *Bulletin of Mathematical Biophysics, 15*(4), 501–507. https://doi.org/10.1007/BF02476438

Shleifer, A. (1998). State versus Private Ownership. *Journal of Economic Perspectives, 12*(4), 133–150. doi: 10.1257/jep.12.4.133

Shleifer, A., & Vishny, R.W. (1986). Large shareholders and corporate control. *Journal of Political Economy, 94*(3), 461–488.

Sieh, L.M.L. (1982). *Ownership and control of Malaysian manufacturing corporations*. Kuala Lumpur: University of Malaya Cooperative Bookshop Publication.

Sime Darby Berhad. (2013). *Annual Report 2012*. Kuala Lumpur: Author.

Simon, H.A. (1959). Theories of decision-making in economics and behavioral science. *The American Economic Review, 49*(3), 253–283.

Smoot, M.E., Ono, K., Ruscheinski, K., Wang, P.L., & Idekar, T. (2011). Cytoscape 2.8: New features for data integration and network visualization. *Bioinformatics, 27*(3), 431–432. doi: 10.1093/bioinformatics/btq675

Sonquist, J.A., & Koenig, T. (1975). Interlocking directorates in the top U.S. corporations: A graph theory approach. *Critical Sociology, 5*(3), 196–229.

Sprenger, C. (2007). *Ownership and firm behavior* (Doctoral thesis, Universitat Pompeu Fabra, Barcelona, Spain). Retrieved from http://www.tdx.cat/handle/10803/7350

Sraer, D., & Thesmar, D. (2006). *Performance and behavior of family firms: Evidence from the French stock market* (ECGI Working Paper No. 130/2006). Brussels: European Corporate Governance Institute.

Stigler, G. (1939). Production and distribution in the short run. *Journal of Political Economy, 47*(3), 305–327.

Su, L.D. (2010). Ownership structure, corporate diversification and capital structure: Evidence from China's publicly listed firms. *Management Decision, 48*(2), 314–339. https://doi.org/10.1108/00251741011022644

Thomson, S., & Pedersen, T. (2000). Ownership structure and economic performance in the largest European companies. *Strategic Management Journal, 21*(6), 689–705. doi: 10.1002/(SICI)1097-0266(200006)21:6<689::AID-SMJ115>3.0.CO;2-Y

Tiffen, M., & Mortimore, M. (1990). *Theory and practice in plantation agriculture: An economic review*. London: Overseas Development Institute.

Venkatraman, N., & Ramanujam, V. (1986). Measurement of business performance in strategy research: A comparison of approaches. *The Academy of Management Review, 11*(4), 801–814.

Villalonga, B., & Amit, R. (2006). How do family ownership, control and management affect firm value? *Journal of Financial Economics, 80*(2), 385–417. https://doi.org/10.1016/j.jfineco.2004.12.005

Vitali, S., Glattfelder, J.B., & Battiston, S. (2011). The network of global corporate control. *PLoS ONE, 6*(10), 1–6. https://doi.org/10.1371/journal.pone.0025995

Walsh, J.P., & Seward, J.K. (1990). On the Efficiency of Internal and External Corporate Control Mechanisms. *The Academy of Management Review, 15*(3), 421–458.

Williamson, O. (1975). *Markets and hierarchies: Analysis and antitrust implications*. New York: Free Press.

World Bank. (2012). *Report on the observance of standards and codes (ROSC): Corporate governance country assessment – Malaysia*. Washington, DC: Author.

Yeh, Y.H., Lee, T.S., & Woidtke, T. (2001). Family control and corporate governance: Evidence from Taiwan. *International Review of Finance, 2*(1-2), 21–48.

Zahra, S.A., Hayton, J.C., & Salvato, C. (2004). Entrepreneurship in family vs. non-family firms: A resource-based analysis of the effect of organizational culture. *Entrepreneurship Theory and Practice, 28*(4), 363–381. doi: 10.1111/j.1540-6520.2004.00051.x

Zhao, J. (2010). Ownership structure and corporate diversification strategies of Chinese business groups. *Management Research Review, 33*(12), 1101–1112. https://doi.org/10.1108/01409171011092167

Zheng, Y., & Chen, M. (2009). China's state-owned enterprise reform and its discontents. *Problems of Post-Communism, 56*(2), 36–42.

Buckley, N. and van Alstyne, M.(2004) "*Does email make white collar workers more productive?*" Technical report, University of Michigan, USA.

Cisic, D., Kesic, B. and Jakomin, L. (2000). "*Research of the power in the supply chain International Trade*", Economics Working Paper Archive EconWPA, April, 2000.

Coffman, T., Greenblatt, S. and Marcus, S. "*Graph-based technologies for intelligence analysis*", Communications of the ACM, Vol. 47, No. 3, pages 45–47, 2004.

Guimer`a, R., Mossa, S., Turtschi, A. and Amaral, L., "*The worldwide air transportation network: Anomalous centrality, community structure, and cities' global roles*", Proceedings of the National Academy of Sciences *USA*, Vol. 102, No. 22, pages 7794–7799, 2005.

Krebs, V., "*Mapping networks of terrorist cells*", Connections, Vol. 24, No. 3, pages, 43–52, 2002.

Rajasingh, I., Rajan, B., & Isido, F. (2009). Betweenness-Centrality of grid networks. International Conference on Computer Technology and Development 2009, pp, 407-410.

Marks, J., Barnett, L. M., Foulkes, C., Hawe, P., & Allender, S.(2013). Using social network analysis to identify key child care center staff for obesity prevention intervention: A Pilot study. Journal of Obesity, p. 1-10.

Badar, K., Hite, J. M., and Badir, Y. F. (2013). Examining the relationship of co-authorship network centrality and gender on academic research performance: the case of chemistry researchers in Pakistan. Scientometrics, Vol (94): 755-775.

Yan, E., & Ding, Y. (2009). Applying centrality measures to impact analysis: A coauthorship network analysis. Journal of the American Society for Information Science and Technology, 60(10), 2107–2118.

Centiserver http://www.centiserver.org/?q1=centrality&q2=Stress_Centrality 19/11/18

Brandes, U. (2008). On variants of shortest-path betweenness centrality and their generic computation. Social Networks, Vol (30): pp. 136-145.

Paul Shannon, Andrew Markiel, Owen Ozier, Nitin S. Baliga, Jonathan T. Wang, Daniel Ramage, Nada Amin, Benno Schwikowski, T.I., 2003. Cytoscape: A software environment for integrated models of biomolecular interaction networks. *Genome Resource*, 13, pp.2498–2504. Available at: http://www.genome.org/cgi/doi/10.1101/ gr.1239303.

Brandes, U., and Erlebach, T. (2005). Network Analysis: Methodological Foundations. Springer. Germany.

Mones, E., Vicsek, L. & Vicsek, T., 2012. Hierarchy measure for complex networks. *PLoS ONE*, 7(3), pp.1–10.

Hanneman, R. A., and Riddle, M. (2005). Introduction to social network methods. University of California, Riverside, USA. Retrieved from http://faculty.ucr.edu/~hanneman/nettext/Introduction_to_Social_Network_Methods.pdf

Krackhardt, D. (1994). Graph theoretical dimensions of informal organizations. In K. M. Carley & M. J. Prietula (Eds.), *Computational organization theory* (pp. 89-111). Hillsdale, NJ, US: Lawrence Erlbaum Associates, Inc.

BIODATA OF STUDENT

Norfaryanti Kamaruddin (GS39190) was born on 8th October 1982 in Kuala Lumpur. She was raised in Kuala Lumpur and in Taiping, Perak. She obtained Bachelor Science of Bio Industry (major in Agricultural economics) and Master of Science in Agribusiness at UPM.

She is married to Khairul Ridzwan Mohd Ibrahim, and blessed with four children – Ayesha Inshirah, Khadija, Fatima and Muhammad. She is currently residing at Petaling Jaya, Selangor.

LIST OF PUBLICATIONS

Roda, J.M., Kamaruddin, N., & Tobias, R.P. (2015). Deciphering corporate governance and environmental commitments among Southeast Asian transnationals: Uptake of sustainability certification. *Forests, 6*(5), 1454–1475. doi: 10.3390/f6051454

Gomez, E.T., Padmanabhan, T., Kamaruddin, N., Bhalla, S., & Fisal, F. (2017). *Minister of Finance Incorporated: Ownership and control of corporate Malaysia*. Institute for Democracy and Economic Affairs (IDEAS). Palgrave Macmillan, Springer Nature. Singapore.

Anseeuw, Ward; Roda, Jean-Marc; Ducastel, Antoine; Kamaruddin, Norfaryanti (2017). Global strategies of firms and the financialization of agriculture. In : Biénabe Estelle (ed.), Rival Alain (ed.), Loeillet Denis (ed.). Sustainable development and tropical agri-chains. Dordrecht : Springer, p. 321-337. http://dx.doi.org/10.1007/978-94-024-1016-7_25